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O. P. BRYSCH, Editor

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1. MANAGEMENT

Gas Heating Gain

Gas Industry Heats 18 Million Homes; Gain of 7 Percent Made in Past Year. New York: Public Information Bureau Release 32-N8, A.G.A. (1958) Apr. 30 (5 pp.)

Gas utility industry added 1,194,000 new house-heating customers last year and increased the number of gas-heated homes by 7.1% to a total of 17.9 million in 1957. Heating customers now constitute 62.5% of all residential consumers, up 2.2% from a year ago. Estimates are that the gas industry will gain another 3.6 million heating customers during the next three seasons. New homes are expected to account for 2.2 million of these installations, while 1.4 million will be installations in existing dwellings.

Gas Sales

Commercial Census Can Aid Sales. F. B. Jones. *A.G.A. Monthly 40,* 9 (1958) Apr. (3 pp.)

Specialized approach, tailored to fit the specific utility definition of the commercial classification, can assimilate valuable management, sales and customer use characteristics data. Commercial census project undertaken by one company enabled identification of customers who use gas as principal space heating fuel, measurement of the size of the gas heating load by heated building volume and by estimate of hourly heating input or manufacturer's rating, inventory of all gas uses, measurement and identification of the maximum annual heating and process potential sales to existing accounts, classification of accounts by customer functions and reclassification of present commercial accounts to the residential and industrial groups.

Appliances

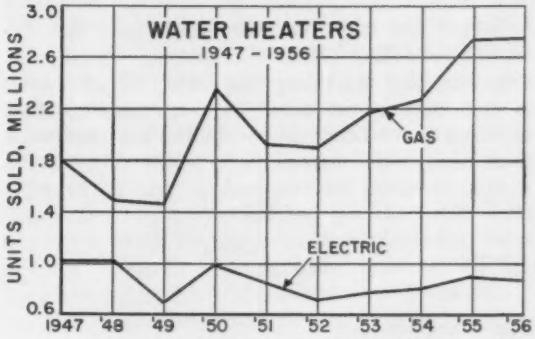
Gas Appliance Outlook for the Years 1958-62. *A.G.A. Monthly 40,* 14 (1958) Apr. (4 pp.); **AGA Predicts 5-Year Gas Heating Market.** *Gas Heat and Comfort Cooling 9,* 22 (1958) May; **Five Year Gas Appliance Outlook.** *Gas Age 121,* 16 (1958) May 15 (2 pp.)

Detailed five-year forecasts for seven classifications of gas appliances indicate the following market potential: 13.9 million gas ranges, 17.7 million water heaters, 5.5 million central heating units, 2.9 million floor and wall furnaces, 13 million space heaters, 3.7 million dryers and 0.5 million gas incinerators. Analysis does not include air conditioning equipment and refrigerators.

Gas Men See Bright Side. *Appliance Manufacturer 6,* 72 (1958) May (2 pp.)

Confident and determined, members of the Gas Appliance Manufacturers Association heard that: gas industry is now serving 40,000,000 customers, more than 1 million above last year; gas ranges outsold electric ranges by approximately 620,000 units; gas central heating shipments are running slightly ahead of last year; over 2,500,000 gas water heaters were shipped last year and 1958 is running ahead of that pace; in the past three years, the ratio of gas clothes dryers to electric has dropped from 1:3½ to a current 1:2.

Ten-Year Record of Automatic Gas and Electric Water Heater Sales



(*Data from* C. Abell.) Abstract *p. 126.*

The Mountain Goes to Mahomet. R. E. Winter. *Gas Age 121,* 20 (1958) Apr. 17 (3 pp.)

Mobile unit containing two kitchens has helped Northern Illinois Gas Co. to bring its gas appliance story to its 600,000 customers over a 10,000 sq mile territory.

Progress Report on Appliance Sales Problems. *Butane-Propane News 20,* 19 (1958) May (3 pp.)

Summary of six appliance manufacturer-LPG dealer forums held in 1957 and attended by 162 industry representatives. Over-all objective: increase LPG market. Immediate objective: increase number of domestic LPG consumers by increasing sale of appliances. Most urgent need: aggressive sales program.

Gas Industry Management

Gas Price Freedom Is More Important to Oil Industry than Import Restrictions. *Gas Age 121,* 38 (1958) Apr. 17.

Remarks from statement made by Harry B. Hilts, secretary of the Empire State Petroleum Association, on the subject of extending the Trade Agreements Act. Statement points out that an important factor limiting impact of foreign oil on domestic producer is the fact that he also produces natural gas liquids. Therefore, most effective relief would be accomplished by removing government-imposed re-

strictions on wellhead prices of natural gas rather than by the most stringent oil-import restrictions.

Selling Is Hot—Buying Isn't. *Business Week 1498,* 62 (1958) May 17 (4 pp.)

Overwhelming marketing fact facing oil companies is that there is too much of everything—product, capacity, retail facilities—everything but customers. Suez crisis, which brought new incentive to expand, ended abruptly, but stepped-up activity to meet crisis didn't. Crude and refinery cutbacks in recent months have helped, but supply-demand picture is still far out of proportion.

Air Conditioners

Surveys Zero-In on the Best Cooling Prospects. R. A. Crane. *Gas Heat and Comfort Cooling 9,* 39 (1958) Apr. (3 pp.)

Approximately $1.5 billion worth of home air conditionings were "bought" not "sold" in 1957. Article points out that a ready market for air conditioning exists, but salesmanship is non-aggressive. Proof: 93% of owners of non-air-conditioned homes have never been contacted by air conditioning salesmen; 26% said they had thought of improvements in their present home cooling methods, and half of these indicated they were potential sales targets for room air conditioners while slightly more than one-fourth said they were prime prospects for central air conditioning.

Promotion

How to Sell the Gas Refrigerator. W. P. Hansen. *LP-Gas 18,* 66 (1958) May (2 pp.)

Gas refrigerator is fundamentally different from anything the electric industry is marketing. Main problem is proper promotion. Features to stress: no moving parts, minimization of labor costs, low costs in comparison to electric consumption rates during protracted hot spells and the elimination of costly rewiring.

How to Sell Gas Water Heaters. C. Abell. *Butane-Propane News 20,* 28 (1958) May (5 pp.)

Although automatic gas water heaters now outsell electric water heaters, the A.G.A. warns that the electric industry is organizing an all-out campaign for this year. A.G.A. is attempting to establish standards for this appliance. Article gives thorough picture of today's market and presents approaches useful in an aggressive sales program.

Pipeline Expenditures

Gas Line Outlays Rise. *Petrol. Week 6,* 78 (1958) Apr. 25 (2 pp.)

Latest American Gas Association figures indicate that about $990 million worth of new gas transmission facilities will be built this year. This is predicted even in face of recession, the Memphis rate decision and other industry problems. Long range prediction: brief leveling-off period; upward climb in years beyond.

Midwestern Pipeline

Three Gas Companies Indicted. *Oil Gas J. 56,* 79 (1958) May 5; Pipelines Feel the Whip. *Business Week 1497,* 29 (1958) May 10; Midwest Gas Plans Opposed. *Oil Gas J. 56,* 93 (1958) May 12.

Three natural gas suppliers are under antitrust indictment as a result of their opposition to a fourth entering the lucrative Upper Mississippi Valley market. Peoples Gas Light & Coke Co., Chicago, American Natural Gas Co., Detroit, and Northern Natural Gas Co., Omaha, were accused of conspiring since 1954 to prevent Midwestern Gas Transmission Co. from importing natural gas from Canada into their marketing territories. Industry lawyers predict that Justice Department might have difficulty proving that the companies' acts can be violations of antitrust laws if they are done by companies under FPC jurisdiction.

Ratemaking

The Economically Possible Gas Price and the Basic Price Tariff. H. Repky. *Gas- u. Wasserfach 99,* 337 (1958) Apr. 11 (13 pp. German text.)

Study provides gas supplier with a basis for establishing a modern gas price tariff. Review of existing tariffs, comparison of competitive energy supplies, estimation of domestic and industrial gas all enter into such a base price. There are no general rules, as each case has its special features.

Acetylene Growth

Latest Developments in Acetylene Derivatives. J. Werner. *Chem. Processing 21,* 34 (1958) May (3 pp.)

Steady growth of acetylene production from 3 billion CF in 1947 to over 6 billion CF/year testifies to the increasing popularity of acetylene-derived products (synthetic rubber, plastics, acrylonitrile and its derivatives, and solvents) and to the continuing development of both low-pressure and high-pressure acetylene chemicals.

Exploration

How Much Does It Cost to Find Oil? R. E. Megill. *Oil Gas J. 56,* 189 (1958) May 12 (4 pp.)

Total expenditures in the search for crude oil in Kansas and Oklahoma has increased fivefold since

1942. From 1942-57, $2.5 billion was spent; yearly expenditures increased from $40 million in 1942 to $250 million in 1957. Yield for this period: 4.5 billion barrels of oil.

Legal

Claims and Litigation Resulting from . . . Spread Blasting and Compressor Station Operation. S. Hammon. *Gas 34,* 128 (1958) Apr. (3 pp); . . . **Explosions in Utility Installations.** S. Hammon. *Ibid.,* 75 (1958) May (4 pp.)

Two-part series discusses some of the litigation suits which have been filed against companies and warns that in many cases technical and scientific evidence cannot be entered into the record at all and that which can be entered receives no more credence than fantastic guesses of local prejudiced witnesses. Author warns that while majority of claims against the gas industry do not terminate in litigation, each claim should be prepared as though this may happen. It insures that the adjuster or attorney who makes the final compromise will be negotiating from a position of strength rather than from weakness.

Suez Program

The Future of Suez. M. Younes. *World Petrol. 29,* 48 (1958) Apr. (3 pp.)

Egypt's new Suez Canal Authority has initiated a 27-month improvement program designed to widen and deepen the canal for transit of 27-ft-draft vessels.

Consulting Service

How Service Companies Serve. N. S. Morrisey. *Oil Gas J. 56,* 94 (1958) Apr. 28 (4 pp.)

Main objective: to provide the right tools to do the job at a specific location. To the small independent operator, a service company provides a type of consultant, cost free, to aid him in his well completion problems. This makes it easier for the small independent to be as effective in his exploration program as a major with its large staff.

Personnel

Hiring Middle Age for What It Can Produce. J. H. Collins. *Public Util. Fortnightly 61,* 666 (1958) May 8 (10 pp.)

Those who seek a new job after reaching 40 years of age are regarded as poor risks by many who believe that after this age a man is washed-up, a liability and a danger to the work force. Uncle Sam has put yardsticks on this notion by labor surveys and reports that many oldsters are good producers —and for utility organizations, have special experience and abilities.

A 10-Point Supervisory Check-Sheet. A. M. Cooper. *Am. Gas J. 185,* 44 (1958) May (3 pp.)

Group of 10 questions aimed to help management evaluate itself. Each point discussed was suggested by industrial executives of broad experience.

Public Relations

Pipelines Push Right-of-Way Relations. *Petrol. Week 6,* 28 (1958) May 2.

Right-of-way representative must be familiar with legal, technical, corporate language, and be versatile enough to convey his information to engineers, government officials, attorneys and laymen in terms they can understand. Right-of-way landman has to be a salesman as well as a practicing psychologist.

Safety

Chemical Engineering and Fire Prevention. *Chem. Process Eng. 39,* 120 (1958) Apr. (4 pp.)

Chemical engineers are conscious of the design and operation of a diversity of processes which by their nature, as well as the nature of the materials being handled, give rise to marked fire hazards. Brief discussion of some of the factors that must be considered in the design, construction and installation of plant and equipment.

Natural Gasoline Plant Safety the Phillips Way. *Petrol. Refiner 37,* 149 (1958) Apr. (4 pp.)

The 1945 accident frequency rate, 23.43/million manhours, caused this company to establish its first formal natural gasoline department safety program. By 1957, the accident frequency rate had been cut to 1.84/million manhours and disabling injuries reduced from the 1945 figure, 156, to nine.

Safe Design and Operation of Chemical Plants. E. W. Jackson. *Chem. Process Eng. 39,* 113 (1958) Apr. (2 pp.)

Article points out that consideration of safety aspects of a plant or process at the design stage has a special importance for the chemical engineer, while suitable safeguards during operation are also important.

Safety in a Modern Chemical Factory. R. D. Bromely. *Chem. Process Eng. 39,* 114 (1958) Apr. 16 (3 pp.)

Installation of a continuous process for the production of stearines and oleines has afforded one manufacturer not only increased efficiency but also increased safety problems. Details of company's well-organized system of accident and fire prevention are discussed.

Safety in the Use of Chemicals. H. Allen, *Chem. Process Eng. 39,* 117 (1958) Apr. (3 pp.)

Most chemicals are the subject of safety codes wherever they are involved in industrial processing or

application; however, new uses and some new materials make it essential for companies to exercise constant vigilance to maintain a comprehensive code of accident-free working.

2. ENERGY SUPPLY AND ECONOMICS

Reserves, 1957

Reserves Climb to All-Time Record. *A.G.A. Monthly 40,* 4 (1958) Apr. (5 pp.)

Net gain of 8.8 trillion CF, fourth greatest in the natural gas industry's history, was realized to raise proved recoverable natural gas reserves to 246.6 trillion CF in 1957. This was achieved even though total net production for the same period climbed to a peak figure of 11.5 trillion CF. Additions to natural gas reserves during 1957 aggregated 20.3 trillion CF, including 9 trillion CF of new discoveries. Extensions and revisions of earlier estimates amounted to 11.1 trillion CF and an increase of 180 billion CF was reported in underground storage.

Petroleum Outlook

Recession: Oil Men See a Silver Lining. *Oil Gas J. 56,* 56 (1958) Apr. 28 (4 pp.)

Drilling has been extremely hard hit but shows signs of picking up; exploration activity is very selective at the present time; stocks of crude are in a much better position—gasoline is still in oversupply but should improve with approach of heavy motoring season; buying of equipment and supplies will pick up soon because oil-company inventories are dropping to the point where replacement buying is imminent; personnel has fared pretty well—companies have cut down hiring, knocked out overtime, but kept full staffs, letting resignations and retirements cut payrolls. Coast-to-coast outlook: optimistic.

LPG Forecast

Forecast: 8.4 Billion Gallon Sales for LP-Gas in 1960. Prepared by A.J.P. Wilson & Assoc. *LP-Gas 18,* 88 (1958) May (2 pp.)

Forecast figure is believed to be low by some in the industry who say this projected rate of growth is lower than the actual increases in sales registered in the past by the industry. Sales of 8.4 billion gallons estimated for 1960 compare with 6.9 billion gallons sold in 1957. Factors contributing to importance of LPG industry: size (fourth largest petroleum product sold), rate of growth (average annual rate of 12% from 1949-56) and uses.

Gas Competition

The Gas Industry in the Atomic Age. J. G. King. *Gas J. 294,* 87 (1958) Apr. 9 (3 pp.); *Gas World 147,* 770 (1958) Apr. 19 (3 pp.); *Gas T. 42,* 25 (1958) Apr. (5 pp.)

Position of gas in energy economy and competition with coal, oil and nuclear energy is discussed and projections are made for total requirements of 1975. High interest in reformed refinery gas, imported liquefied methane and Lurgi gasification are discussed.

Oil and Gas Supply

The Future Supply of Oil and Gas. B. C. Netschert. Baltimore: Johns Hopkins Press (1958); reviewed in *Chem. Eng. 65,* 167 (1958) May 5 by J. B. Bacon.

Optimistic outlook prevails in this book which predicts for primary recovery, maintenance of continued growth in primary capacity; for secondary recovery, a period of explosive growth and for natural gas, possibility of considerable expansion in imports.

Energy Sources

The Outlook for High Btu Gas from Coal. M. A. Elliott. *Coal Age 63,* 120 (1958) May (6 pp.)

Long-run forecast in natural gas economics coupled with continued promise in search for low-cost methods of converting coal to high-Btu gas authors prediction that sometime during the 1970's (and perhaps the late 1960's) coal-based synthetic natural gas will become a commercial reality. Among the most promising methods are methanation of synthesis gas and direct hydrogenation of pretreated coal.

TVA Power Rates

Measuring the Yardsticks. J. C. Mellett. *Public Util. Fortnightly 61,* 600 (1958) Apr. 24 (4 pp.)

Tennessee Valley Authority, hailed 25 years ago as a yardstick (presumably for the measurement of electric rates and electric utility operations in other areas of the country) is evaluated. General feeling is that as a gage of the reasonableness of electric power rates, the yardstick was inaccurate because it was carefully laid away from capital costs, including interest and repayment and to one side of taxes.

Competitive Energy

Two Sure Ways to Outsell Electricity. L. H. Lemon. *LP-Gas 18,* 68 (1958) May (3 pp.)

In addition to using the many advantages of gas and using competitive rate analysis, salesman must have faith in what he sells. Selling points to remember: speed and controllability of gas vs. electric appliance, efficiency, safety, acceptance, rate comparison and modernity.

Electricity

The Productivity of Electricity. R. W. Rosen. *Public Util. Fortnightly 61,* 505 (1958) Apr. 10 (6 pp.)

Assumption that productivity of electricity is constantly increasing in this dynamic society is challenged. In fact, during the period 1947-55, productivity of electricity in manufacturing operations in the U.S. actually declined by one-fourth.

Peak Load

What Does It Cost to Produce Peak Shaving and Substitute Gases? M. P. Griffith. *Am. Gas J. 185,* 47 (1958) May (5 pp.)

Need exists for recording and analyzing operating costs of present processes of manufacturing substitute gas for natural. Such data would enable analyses to determine methods which would lower costs so that when substituted gas is increasingly used, the price will enable the continuation or even expansion of markets for gas.

Coal

Giant at Rest. *Coal Utilization 12,* 26 (1958) Apr. (4 pp.)

Bureau of Mines figures indicate that stockpiling is dominated by three major coal consumers: electric utilities, 48.9 million tons; coke ovens and steel mills, 14.4 million tons and a group of general manufacturing industries, 12.6 million tons. These groups are holding 76 of the 80 million tons of coal above the ground today.

Sulfur Market

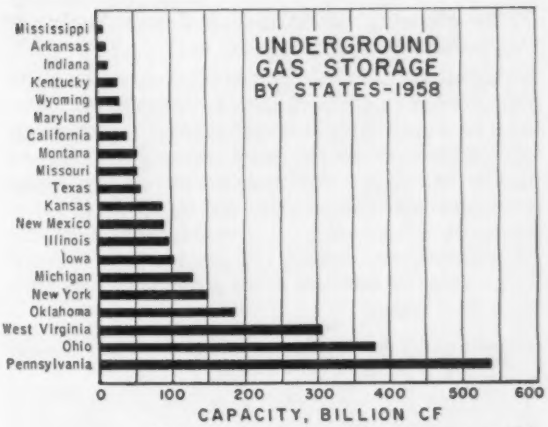
Sulphur Begins to Stabilize. *Business Week 1496,* 66 (1958) May 3 (2 pp.)

Traditionally stable world sulfur market went on a round of price cutting starting in 1956. Industry-generated shifts are responsible for departure from the norm. Competition from Mexico has caused a decline of 1 million tons on production for Texas Gulf; in one Canadian plant, the Claus process, which extracts sulfur from "sour" natural gas, can turn out 325 tons of elemental sulfur daily. Worth $7125 at market prices, cost of production is claimed to be $650. Forecast: over-all market situation appears to have settled down and a sulfur price increase soon is awaited.

Offshore Operations

Disputed Louisiana Lease Looks Hot. *Oil Gas J. 56,* 72 (1958) May 5 (2 pp.)

State and federal agencies finally have agreed to allow drilling in the great unchartered waters off the coast of Louisiana after years of wrangling going back to Huey Long. Successes in nearby offshore blocks mean the area should be a producer.



(*Adapted from* R. B. Bizal.) Abstract *p. 136.*

Euratom

U.S. Gets Atomic Partner. *Business Week 1498,* 44 (1958) May 17.

Agreement with Euratom calls for joint effort to build six or seven large nuclear power reactors in Western Europe over next five years. Plan gives West Europe financial backing and technical know-how, and the U.S. a market for reactors.

Nuclear Energy

Nuclear Power Piping Codes Progress Toward Standardization. V. T. Malcolm and S. Low. *Heating, Piping & Air Conditioning 30,* 132 (1958) May (4 pp.)

Increasing progress being made in applications of nuclear energy has accelerated efforts to meet the need for standardization of inspection and testing methods of piping systems. Many of the current specifications are unrealistic and are largely responsible for today's high costs of nuclear energy because they attempt to provide insurance against all contingencies.

Nucleonics. W. W. Meinke. *Anal. Chem. 30,* 686 (1958) Apr. (43 pp.)

Review of publications in nucleonics from late 1955 to late 1957 follows material presented in previous review. Publications reviewed indicate a large expansion in the number of papers on radioisotopes, an increase which appears to have been fostered by the International Conference on the Peaceful Uses of Atomic Energy held at Geneva in August, 1955, and to have been abetted by the recent declassification in the United States of a wealth of analytical information. Bibliography cites 1279 items.

PWR—Meaning to Reactor Builders. *Nucleonics 16,* 56 (1958) Apr. (8 pp.)

First full-scale atomic power plant exclusively for the generation of electricity at Shippingport, Pa., is a laboratory for the entire nuclear power industry, particularly for the water reactors field. It is a facility in which a variety of designs of light water moderated and cooled cores can be operated and it is expected that such a program of testing a number of different core designs will provide data that will help determine fuel cost of the power produced from each core design.

Shippingport Power Costs—What Do They Mean? *Nucleonics 16,* 60 (1958) Apr. (2 pp.)

Tabulation and interpretation of power costs. Table gives inferred power costs such as a private firm would incur in producing electricity at Shippingport, Pa. Not taken into account is the out-of-pocket expense to the government for experimental operations. Detailed breakdown of Shippingport power costs shows 64.4 mills/kwh net.

Steady Steps to Fusion Power. *Business Week 1497,* 35 (1958) May 10; **New Routes to Fusion Power?** *Chem. Eng. News 36,* 34 (1958) May 19.

Next fall, at Geneva, the world's leading atomic scientists will hear about the progress being made in government-financed laboratories on the four methods which may lead to an economical fusion reactor. Reports will be made on stellarators, mirror machines, the Luce ignition system and the "pinch bottle" experiments.

Radiation Applications

Irradiation Sources for Industry. M. R. Jeppson. *Instruments and Automation 31,* 639 (1958) Apr. (5 pp.)

Radiation uses by industry have been hindered by lack of suitable radiation sources. Article appraises various radiation sources, compares advantages and costs of radioactive waste and other reactor sources versus accelerators of various types.

Canadian Oil and Gas

Canada—An Expanding Economy. E. S. Graham and E. C. Sievwright. *World Petrol. 29,* 59 (1958) May (3 pp.)

Oil consumption in Canada rose 6% in 1957, crude production and refinery activity over 7%. Drilling was depressed following a cut in export crude demand. But over-all outlook anticipates a doubling of demand over next 10 years. Canada has an established pipeline system which is without equal when it is realized that it is only 10 years since first major crude-oil discovery. Oil men expect long-run growth of industry.

Canadian Reserves

Borden Commission Examines Gas. *World Petrol. 29,* 114 (1958) May.

Commission's interim report contains two positive conclusions of vital importance to the Canadian industry: 1) Canada has huge gas reserves for staying 30 years ahead of its own requirements; 2) logical markets for the surplus are in the USA, and, without these markets, the Canadian gas industry will never realize its full potential.

Natural Gas in Western Canada. F. K. Beach. *World Petrol. 29,* 65 (1958) May (3 pp.)

Experts estimate ultimate reserves at 300 trillion CF awaiting export market development. West-coast market expansion indicates probable doubling of new line. Last leg of Trans-Canada line should be completed this year.

Canadian Petrochemicals

Petrochemicals. *World Petrol 29,* 79 (1958) May (3 pp.)

Half of the current investment in the chemical industry in Canada now is going into petrochemicals. Output represents 50% of all industrial chemicals and 80% of all organics produced in the dominion. Petrochemicals in Canada are produced from natural gas on the prairies and from refinery effluents in the large centers at Sarnia, Ont., and at Montreal.

Sahara Exploration

Three Good Strikes Boom Prospects for Sahara Desert. M. Moyal. *Oil Gas J. 56,* 91 (1958) May 5 (4 pp.)

Three successful strikes have opened a vast area in the desert for possible oil and gas production: Edjele, Tiguentoruine and Zarzaitine. At Edjele, 23 wells have been completed to date, 21 of which are producing 150-250 bbl/day. At least 500 wells will be required to insure ultimate recovery of the estimated 773 million barrels in place. The Tiguentoruine has three separate domes. Two tests have established gas and oil reservoirs in the Lower Devonian and Tournaisian on the north dome in a zone at 4556-4615 ft tested 25 bbl of crude per hour. Another interval between 2943-5212 ft yielded 300,000 CF of wet gas. Predictions for Zarzaitine claim that the new pool will surpass Edjele.

Algerian Future Is Looking Good. *Oil Gas J. 56,* 89 (1958) May 5 (2 pp.)

New field at Zarzaitine was completed by the Cie. Recherches et d'Exploitation de Petrole au Sahara two years after the company made the Sahara's first commercial discovery at Edjele. But located as it is, 550 miles south of the Algerian Mediterranean

coast, transportation is proving to be a barrier for the French because of a political hitch.

Syria Exploration

Syrian Field Impressive. *Oil Gas J. 56,* 83 (1958) May 5 (2 pp.)

Syria's first commercial oil field, Karatchok, dissovered in 1956, now has its fourth successful well completed, but marketing plans still are not definite. Operation and exploration is being conducted by a German company. This field may be the only chance of Syria for private industry.

British Gas

The Future Needs a National Fuel Policy. J. G. Tilley. *Gas J. 294,* 188 (1958) Apr. 23 (3 pp.)

Objective of national policy would be reduction in the cost of gas to the consumer. Most vital need: cheaper production methods. However, for the next several years, there can be no major saving in overall production costs. There is room for all the fuel industries to expand, but it is essential that they should do so in such a manner as will insure economic basic coal consumption. Future prospects offer opportunities for both gas and coke industries.

Chemical Engineering Economics

Chemical Cost and Probability Estimation—1957. J. B. Weaver. *Ind. Eng. Chem. 50,* 753 (1958) May (10 pp.)

Annual review of chemical engineering economics includes oral and written presentations in the field of investment, operating cost and profitability estimation for the process industries. Annotated bibliography covers 329 items.

Chunking Discovery

Chinese Reds Excited. *Oil Gas J. 56,* 112 (1958) Apr. 21

Three prime discoveries, 100 miles from Chunking, have been shut in after flowing more than 400 bbl/hr on tests. All three are in a region that has never before produced oil in commercial quantities. More than 3000 experts are being sent to the new oil area.

Solar Heat

Prize-Winning Designs for a Solar-Heated Residence. *Air Conditioning, Heating and Ventilating 55,* 76 (1958) May (2 pp.)

Three top prize-winning designs in the 1957 International Architectural Competition, sponsored by the Association for Applied Solar Energy, for a solar-heated residence. General scope and purpose of competition are outlined, as well as design conditions and requirements that had to be met.

Water Resources

Resource Studies: Key to Water Planning. R. C. Smith. *Battelle Tech. Rev. 7,* 9 (1958) May (6 pp.)

Sharp rise in water demand calls for continual improvement in planning and management of water consumption in the U.S. Modern science and technology can provide much of the knowledge for accomplishing this. At present, rainfall and streamflow records of U.S. Weather Bureau and the Geological Survey indicate no long-term trend either downward or upward in the nation's gross supply of water.

Fuel Cell

Fuel Cell. E. Justi and F. H. Spengler (assigned to Ruhrchemie Akt.) U.S. 2,830,109 (1958) Apr. 8.

Fuel cell is claimed comprising a central porous ceramic cup formed by casting (or by molding and sintering) a silicate-free salt of alkali or alkaline earth metals (Na_2CO_3,$MgCO_3$) which is filled with granular coal and has an axially located metal or graphite rod or tube as anode. This cup is surrounded by an outer concentric layer of granular copper oxides (cathode) contained in a heat-resistant casing, with a sweep-flow of oxygen from the bottom. With the whole cell at 700°-800°C, one volt is obtained. Hydrogen or fuel gases may be burned in central cell by replacing coal with granular metal.

3. NATURAL GAS AND PETROLEUM PRODUCTION

Alberta Reserves

Pre-Cretaceous—Alberta's Big Source of Oil; Cretaceous—Alberta's Big Source of Gas. J. R. Pow. *Oil Gas J. 56,* 151 (1958) Apr. 28 (3 pp.)

To date, approximately 27% of the recoverable oil reserves and 41% of the disposable gas reserves of Alberta have been discovered within the conglomerate and sandstone reservoirs contained by formations of Cretaceous age. Remaining reserves have been found nearly entirely in limestone and dolomite reservoirs of the underlying formations of Mississippian and Devonian age.

Coal

"The Economics" in the Choice & Use of Coal. *Coal Heat 74,* 5 (1958) May (17)

Article treats those factors and interrelated variables that affect the choice, performance, use of fuel, its availability, characteristics, production, transportation and distribution, with particular reference to consumer's requirements, physical facilities, operating conditions, the human equation and comparative utilization costs.

Drilling

Cost Controls for the Drilling Contractor. W. H. Helmerich III. *Drilling 19,* 68 (1958) May (3 pp.)

Review of one company's experience with contract footage bid. Company prefers this method because 1) computing total cost by building up the sum of component smaller costs will always lead to greater accuracy than a single estimate of the total itself, and 2) someone can be held accountable for estimates that are made before the job starts.

Gas Hunted in Eastern Canada. *World Petrol. 29,* 84 (1958) May (2 pp.)

Drilling activity in eastern Canada in 1957 was about the same as in previous years. Activity in the St. Lawrence lowlands and in the Maritimes continued to be unrewarding. Out of 27 wells drilled, only two gassers were completed; no oil wells. One gas discovery appears to be a one-well pool since two offsets were dry.

How to Make Profit Below 15,000 Ft. H. J. Reedy. *Oil Gas J. 56,* 166 (1958) Apr. 14 (5 pp.)

Breaking of "depth barrier" at Carter-Knox (Okla.) has extended the trend to deeper drilling and depths up to 25,000 ft. are now being considered. With the holes properly engineered from the surface for size, casing, drilling fluids, etc., the successful drilling to these depths can be accomplished.

New Chart for Evaluating Drilling Operations. L. M. Crane and A. C. Perricone. *Oil Gas J. 56,* 112 (1958) Apr. 14 (2 pp.)

Chart has been designed to obtain drilling data sometimes overlooked. Use of the chart can enable rapid determination of pump output, tank volume, annular velocity and mud gradient while eliminating cumbersome calculations.

New Lightweight Portable Rig Unveiled. *Petrol. Week 6,* 49 (1958) Apr. 25 (2 pp.)

Highly portable rig, "The Mighty Mole," worth $500,000, is said to be a radical departure in portable, lightweight drilling equipment. It has been introduced by a California drilling contractor.

A New Record—15,868 ft of 9⅝-in. Casing. E. McGhee. *Oil Gas J. 56,* 91 (1958) Apr. 28 (3 pp.)

Careful planning enabled Phillips Petroleum Co. to run what is believed to be the longest string of this size pipe ever run. Location: Pecos County, Texas.

A New Record for Air Drilling. E. McGhee. *Oil Gas J. 56,* 109 (1958) May 5 (2 pp.)

Deepest hole ever drilled with air is located at Bustin Canon in Terrell County, Texas. In January the well reached a depth of 14,759 ft, and all but 900 ft had been drilled with air as circulating fluid.

New Ways to Evaluate Formations. H. M. Johnson. *Oil Gas J. 56,* 105 (1958) Apr. 14 (5 pp.)

Problem of formation evaluation has become more difficult with advances in technology, e.g., rotary drilling. Drilling engineer and geologist should formulate the mud program for a well together, with each realizing the needs of the other. Coordinated program can result in safe and rapid drilling, sound and dependable formation evaluation and well completion at maximum production capacity.

Operators in the Anadarko Hit Nearly One Out of Two. W. E. Swearingen and A. C. Hayden. *Oil Gas J. 56,* 230 (1958) Apr. 21 (4 pp.)

Graphical and tabular survey of drilling costs, producing-zone frequency, wildcat drilling success, discoveries in the Northern Anadarko basin and reservoir data.

Simultaneous Drilling. W. A. Theriot. *J. Petrol. Tech. 10,* 13 (1958) Apr. (4 pp.)

Radical new method consists of drilling two directional wells alternately from a single rig and using a single drilling crew. Originally used with turbodrills, method may be adapted for rotary drilling equipment. Not intended for wildcat drilling, it finds its widest application in development drilling, particularly offshore platforms.

Use of Chemicals to Maintain Clear Water for Drilling. J. P. Gallus, J. L. Lummus and J. E. Fox, Jr. *J. Petrol. Tech. 10,* 70 (1958) Apr. (6 pp.)

Fresh water or brine drilling fluids may be kept free of suspended drilled solids by adding a water-soluble acrylamide-carboxylic acid copolymer at the flowline. Addition of from 0.01-0.2 lb/bbl of polymer solution to drilling fluids containing less than 5% of clay solids by weight causes the solids to settle rapidly. Solutions of polymer injected at the pump suction reduce loss of water to permeable formations without impairing the permeability to oil. Use of drilling fluids clarified with the polymer has resulted in increased drilling rates, extended bit life and lower drilling fluid costs.

Washington Well Produces Hard Rock Drilling Lesson. J. D. Miller. *Drilling 19,* 65 (1958) May (3 pp.)

Progress in the Rattlesnake Hills area of Benton County, Wash., was slow despite use of air drilling techniques and carbide insert bits. Net result . . . 10,655 ft in 220 days. Well furnishes good performance comparison for air, aerate and mud drilling.

Drilling Muds

Salvaged Mud Saves $813,670. D. M. Jeffus, Jr. and V. T. Jones, Jr. *Oil Gas J. 56,* 119, (1958) Apr. 14 (3 pp.)

This amount has been saved by one corporation at Timbalier Bay, La. Only three things are required for economical operation: 1) shallow-water field, 2) only one type of mud should be in use and 3) equipment to centrifuge and store surplus should be available.

Surfactants Score on Three Counts. L. Lawrence. *Oil Gas J. 56,* 122 (1958) Apr. 14 (2 pp.)

These materials provide lubricity and stability at abnormal temperatures. They give faster penetration rates (increase of 10-30% in most instances), better bit performance and better shale handling.

Exploration

Gas Heads North in British Columbia. N. S. Morrissey. *Oil Gas J. 56,* 167 (1958) May 5 (2 pp.)

Four strikes at Ft. Nelson could easily be forerunner of a vast new gas field, comparable to the multipay fields at Ft. St. John, Boundary Lake and the more recent gas and oil strikes at Blueberry River. Four discoveries embrace nearly 400 sq miles that are potentially productive.

The McAlester Basin Is Stirring. *Petrol. Week 6,* 19 (1958) May 2 (2 pp.)

Latest discovery in LeFlore County, eastern Oklahoma, was in the No. 1 McBee Section which flowed 7,642,000 CF of gas daily through perforations at 5515-38 ft and 5630-70 ft in the Spiro sand, after fracture treatment. Two oil discoveries have been made in Coal County, on the southwest edge of McAlester Basin.

Offshore Operations

Some Developments in Marine Drilling Foundations. A. Kranendonk. *J. Inst. Petrol. 44,* 81 (1958) Apr. (16 pp.)

Drilling platform requirements and the considerations arising in the selection from among three basic types are discussed. Evolution and construction of the three different platforms are detailed.

Reservoir Engineering

Miscible Fluid Displacement in Porous Media. J. W. Lacey, A. L. Draper and G. G. Binder, Jr. *J. Petrol. Tech. 10,* 76 (1958) Apr. (4 pp.)

Experimental study of miscible fluid displacement was conducted in linear porous media under highly adverse mobility ratio conditions. Various refined oils were displaced at field rates by liquid propane in both horizontal and vertical models, 9-36 ft in length. In horizontal tests, mixed zones form between the two liquids early in the displacements. In vertical displacements controlled by gravity drainage, only short transition zones form. Therefore, in reservoirs having characteristics allowing a high degree of gravity drainage, nearly complete oil recovery should be attainable by miscible fluid displacement.

Some Mathematical Aspects of Two-Phase Flow with Applications to Flooding and Gravity Segregation Problems. J. C. Martin. *Producers Monthly 22,* 22 (1958) Apr. (11 pp.)

Solutions are given for four types of problems concerning two-phase flow in porous media. Two types of problems are concerned with gravity segregation. In these problems, there is no flow across the boundaries. In one instance, the fluids are initially uniformly distributed, and in the other, the fluids initially completely segregated. An example is presented which indicates that in many cases the gas that is free to flow segregates to the top of the sands very rapidly.

Secondary Recovery

Bone Up on the Legal Tools. R. R. Huff. *Oil Gas J. 56,* 124 (1958) Apr. 14 (4 pp.)

Pressure-maintenance and secondary recovery programs by the injection of gas, water flooding and combined injection of water and gas have resulted in vast increases in oil production. Lease owners and operators of marginal or near-marginal producing leases usually realize that they must take positive action toward secondary recovery. Article surveys necessary legal steps.

Effect of Curtailment on Ultimate Oil Recovery by Secondary Water Flooding. C. R. Hocott. *Producers Monthly 22,* 44 (1958) Apr. (12 pp.)

Based on field experience, theory and laboratory experimentation, it is concluded that curtailment of oil production and water injection will not result in loss of ultimate oil recovery in secondary water floods. In fact, in natural reservoirs comprising heterogeneous sands with intercommunicating lenses or strata where capillary effects are significant, reduction in rate of flood advance will probably enhance oil recovery.

Well Practice

How to Control Slurry Density during Cementing Operations. J. P. Moran and D. G. Hartweg. *Oil Gas J. 56,* 88 (1958) Apr. 28 (3 pp.)

New densitometer not only measures exact density of the slurry being pumped into the well, with an accuracy of 0.1 lb/gal, but provides a continuous record of slurry density throughout cementing job.

Petroleum

Oil Production Method. R. V. Hughes (assigned to Gulf Oil Corp.) U.S. 2,828,819 (1958) Apr. 1.

Method is claimed for forcing the oil layer in an underground reservoir (with a free oil-water contact) in a horizontal direction to an accessibly located well, by withdrawing only the water or gas from other wells nearby and reinjecting water or gas into its own zone at a more distant well, to produce tilting of the oil-water or oil-gas contact surface.

4. GAS CONDITIONING AND LPG RECOVERY

Carbon Dioxide

Scrubber Process for the Absorption of Carbon Dioxide by a Potash Solution. I. G. Plit. *Zhurnal Prikladnoi Khimii 31,* 186 (1958) No. 2 (6 pp. Russian text.)

Absorption coefficient as a function of liquid phase velocity and gas phase parameters. Henry's constant as a function of CO_2 concentration, and relative gas velocity, are determined.

Assoc. Tech. Services, Inc.

Carbonization

Eliminating Unnecessary Rodding on Continuous Vertical Retorts. S. K. Hawthorn. *Gas T. 42,* 52 (1958) Apr. (2 pp.)

Birmingham Gas Department plans to use a thermograph device to indicate need for rodding and to eliminate wasted effort. Method: gas offtake temperature of selected retorts was first recorded by a thermograph with the mercury in steel thermometer fitted into the offtake rodding hole, and the retors were rodded only when necessary to maintain coal travel. Upward, downward and lambent heated retorts with major axis varying between 62-103 in. were included; experiments indicated that hourly rodding was unnecessary.

Dehydration

Effects of Hydrates on Automated Transmission & Gathering Systems. W. M. Owen. *Gas Age 121,* 49 (1958) May 1 (4 pp.)

Discussion of preventive and corrective measures for freezing conditions at vital points in the automated gathering and transmission systems.

Dust Removal

Considerations for Controlling Dust and Fumes. R. F. O'Mara and C. R. Flodin. *Chem. Eng. 65,* 139 (1958) May 5 (4 pp.)

Whatever the reasons for controlling dust and fumes, an engineer usually designs a system for cleaning dirty gases. Article points out key factors and offers new guides for a ubiquitous problem.

Hydrogen Sulfide

Intensification of Hydrogen Sulfide Removal from Coke Oven Gas in High-Speed Rotary Absorbers. S. N. Ganz and M. A. Loshkin. *Zhurnal Prikladnoi Khimii 31,* 191 (1958) No. 2 (7 pp. Russian text.)

Use of above arsenic-soda absorbers is shown to afford better purification than packed towers and a decrease in volumes of reactants, metals used, power and capital expenditures. Effect of peripheral velocity and design of disks, amount of liquid contained in unit, gas space velocity and physicochemical factors is determined.

Assoc. Tech. Services, Inc.

LPG

Wellman Plant Uses Ammonia Cycle. J. A. Newsome, Jr. *Petrol. Refiner 37,* 147 (1958) Apr. (2 pp.)

Gas liquids recovery plant applies refrigeration equipment that not only serves to furnish low temperatures but also dehydrates the residue gas. Investment was cut by using hydraulic system for driving process pumps and cooling tower fan.

Motor Fuel

Can 'Mn' Help Natural Gasoline? *Petrol. Week 6,* 32 (1958) May 2 (2 pp.)

Ethyl Corporation's new manganese-base antiknock compound, called AK-33X, may help open door for more natural gasoline in motor-fuel market. Its chemical name is methyl cyclopentadienyl manganese tricarbonyl. Since its introduction last summer, it has undergone extensive testing by Ethyl and other interested petroleum companies.

Natural Gasoline

How This Plant Went Automatic. J. A. Gordon. *Petrol. Refiner 37,* 136 (1958) Apr. (4 pp.)

Union Oil Company's Playa Del Ray plant (Calif.) treats low pressure wet gas from the nearby Venice oil field at approximately 37 lb and high pressure gas from its gas storage reservoir at approximately 300-500 lb. Current volumes treated are approximately 2000 MCF/day of low pressure gas, and approximately 3000-4000/day of high pressure gas. Gasoline production is 6500 gal/day of a 48-lb Reid Vapor Pressure product.

Natural Gasoline's "Road Back" May Be Long, Hard and Full of Surprises. *Petrol. Week 6,* 42 (1958) Apr. 11 (7 pp.)

Natural gasoline's use as a blending compound fell off during the octane race, but that may change. Just how fast and how far it comes back will depend on some vital decisions now facing natural gasoline producers, and on related developments taking shape in the oil industry as a whole.

Separators

A Method for Determining Optimum Second Stage Pressure in Three Stage Separation. K. F. Whinery and J. M. Campbell. *J. Petrol. Tech. 10,* 53 (1958) Apr. (2 pp.)

Development of a correlation tool for the field engineer which is simple and accurate in predicting optimum second stage separation pressure in three stage separation operations. No variations in temperature were considered in the study.

5. NATURAL GAS TRANSMISSION

Communications

Telecontrol—Central or Sectionalized? F. V. Long. *Gas 34,* 161 (1958) May (2 pp.)

Medium to long pipelines usually present management with a choice of two types of operation, central or sectionalized control. Deciding factor in many cases is the reliability of the communication system which must transmit the telecontrol intelligence. As a rule it is simpler to limit the distance between controlling and controlled points because with any type of communication system, the more wire or microwave links between points, the more equipment is involved and the law of failure averages begins to mount.

Compressors

Gas Pulsations—The Problem, Southern Gas Association's Approach, Results. E. N. Henderson. *Oil Gas J. 56,* 115 (1958) May 12 (7 pp.)

Nontechnical discussion of SGA's pulsation research project summarizes the problems of gas pulsation as to cause and effect, outlines approach to solution of problems and reviews results and their practical application. Text and examples use natural gas compressors, mostly transmission installations, as a basis for discussion.

LPG

LPG Transportation Trends. *LP-Gas 18,* 115 (1958) May.

Excerpts from important parts of the report of the LP-Gas Transportation Subcommittee includes discussion on pipeline transportation, tank car transportation, tank truck transportation and barge and tanker transportation.

Lubrication

F-R Turbine Lubricants. J. J. O'Connor. *Power 102,* 73 (1958) May (5 pp.)

Utility company managements are still groping for adequate answers to their technical problems. There has been a marked absence of basic research into many of the unique problems associated with the use of synthetic fluids as turbine lubricants. Duquesne Light Co. plans to install a fire-resistant lubricant in an operating steam turbine-generator in May. Their findings will strongly influence the future of synthetic fluids.

Odorization

Gas Odorization in Distribution Systems. *Am. Gas J. 185,* 33 (1958) May (4 pp.)

Responsibility for maintenance of a safe odor level in a distribution system rests with the distribution utility. This distribution utility may purchase untreated gas from the transmission company, then add enough odorant to meet the safe odor requirement. Refresher on fundamentals of odorants, utility practices, control, types of manufactured injection odorizers, meter pumps and positive displacement chemical feed pumps is presented.

Pipeline Construction

Cost Analysis in Pipe Line Design. D. Vondy. *Pipe Line Ind. 8,* 66 (1958) Apr. (6 pp.)

Comprehensive summary of basic engineering economics that will aid in the determination of optimum system design. Graphical cost data on station site selection, power costs, line sizing and more accurate estimates.

Pipeline Operations

Effectiveness of Blowing Out Dust from Gas Transmission Lines. I. E. Khodanovich. *Gasovaya Prom.* 45 (1958) 3 (5 pp. Russian text.)

Dust in mains was responsible for erosion of pistons, cylinders, regulators and other equipment. Dust samples were examined, necessary gas volumes determined to remove dust of varying water contents from mains and curves given to show that these velocities are not attained in usual practice except near open end of pipe. Mechanical removal is recommended if dust is wet, to be followed by blow-down. Dry dust requires an air velocity of 25 m/sec to start dust removal and 6 m/sec to remove the heavier particles. Blow-down should be made on short sections of pipe (5 km) by connection to a pipeline at least twice its length before opening end of line to be blown-down to atmosphere.

J. W. Penney

Gas for Gotham. Three Major Pipeline Systems Bring Natural Gas to New York. J. F. Ebdon. *Gas 34,* 123 (1958) May (17 pp.)

Three major pipeline companies delivering gas to New York are described. Tennessee Eastern Transmission Co. supplied, in 1957-58 season, 7.8

MMCF/day; Tennessee Gas Transmission Co. supplied 75 MMCF/day and Transcontinental Gas Pipe Line Corp. supplied 347.2 MMCF/day, or a total of 430 MMCF/day. Improvement of facilities, especially in Pennsylvania storage fields, will permit a peak day delivery of 1.5 billion CF before 1960. Special descriptions of Transco's facilities, covering gas supplies, pipelines, compressors, storage and the New Jersey-New York area dispatching system, are given.

Pipeline Gathering Systems Essential to Profitable Offshore Operations. J. W. Calvert. *World Petrol. 29,* 44 (1958) Apr. (4 pp.)

Since the first offshore wells were completed in 1947, it was obvious that gathering oil by barge involved high costs. This fact spurred construction of submarine pipeline systems, 100 miles of it in 1957 alone with another 100 miles planned for 1958. But the end-of-the-year total underwater pipeline mileage, 300 miles, is an infinitesimal amount considering the thousands of square miles of ocean floor which form the pattern of submerged oil and gas fields.

Sui-Multan Pipeline Ready to Supply Gas. *Progress 2,* 1 (1958) May (2 pp.)

Sui gas from Pakistan's fields should reach Multan in May via a 16-in. diam transmission line which traverses 334 miles of terrain. Three months ahead of schedule, this is Asia's second long distance natural transmission line and will make available to northern parts of West Pakistan abundant supplies of natural fuel.

Valves

Valve Operator Control Systems for Compressor Stations. H. L. Ledeen. *Gas 34,* 140 (1958) May (9 pp.)

Description of valve operator control systems applied to conventional line valves in gas compressor stations for automatic or remote operation. All systems described have a practical bearing on automation of gas compressor stations. Developments which will follow in near future have already had their previews in such form as a more refined electro-hydraulic operator, better utilization of pneumatic control signals, more accurate positioner controls, introduction of closed loop servo systems and a whole family of supervisory control actions which must be acted upon by valve operator controls.

Pipeline Construction

Self-Centering Pneumatic Inside Line-Up Pipe Clamp Assembly. F. S. Miller (assigned one-fifth each to N. M. Miller, E. L. Van Laningham, G. L. Thomas and J. L. Miller.) U.S. 2,830,551 (1958) Apr. 15.

Improved pipe line-up clamp is claimed, comprising a pair of radial expandable structures, carried on heavy supporting rods, and spring-driven radially expanding rods for engaging inner surface of the two abutting pipe ends, with longitudinal ram to hold ends together for welding.

6. GAS AND LPG STORAGE

Liquefaction

Security for Converted Cargo Ship to Take First Gas Load to U.K. H. H. Carlson. *Gas J. 294,* 131 (1958) Apr. 16 (2 pp.)

Technical information on the 5000-ton S.S. Normati, which will be used later this year to convey liquefied natural gas to Canvey Island, is difficult to obtain. Constock Liquid Methane Corporation uses guards to protect it for onshore security, bans photographers and assigns workers to specific sections of the vessel. Storage tanks are under construction at another point. (See *Gas Abstracts 14,* 71.)

Underground Storage

Gas Storage Venture. S. M. Parkhill. *Compressed Air 63,* 18 (1958) Apr. (4 pp.); **See Steady Growth in Gas Storage.** *A.G.A. Monthly 40,* 2 (1958) May (2 pp.)

Description of storage field 18 miles north of St. Louis in a 100-ft stratum of St. Peter sandstone, 1450 ft deep. Injection began on December 2, 1955, and as of January, 1958, there is 5 billion CF in storage, with ultimate capacity estimated at 45 billion CF. Operations of field and of St. Louis distributing system are described.

More Gas Being Stored Underground. R. B. Bizal. *Oil Gas J. 56,* 84 (1958) May 12 (5 pp.)

Annual survey shows that with present and planned facilities, the industry will be able to store more than 2.3 trillion CF of natural gas in underground reservoirs. This is 15.7% higher than the 1957 figure, and 45% more than in 1955. A 20-state breakdown is included.

Two Central Pennsylvania Gas Fields to Be Converted to Underground Storage. *Gas Age 121,* 37 (1958) Apr. 17 (2 pp.)

Three companies, New York State Natural Gas Corp., Pittsburgh, Trancontinental Gas Pipeline Corp. and Texas Eastern Transmission Corp., will participate in a $25 million project that will ultimately add 60 billion CF to the East Coast storage "cushion."

Underground Storage for Petroleum. National Petroleum Council. Washington, D.C., 1957.

Last report, issued in 1952, indicated that develop-

ment of underground storage would be such that a subsequent study would be mainly a record of achievement by industry rather than a survey of possibilities and feasibilities. Figures show that underground storage in continental U.S. for liquid petroleum products now totals well over 25,000,000 bbl vs some 7,000,000 in 1952. Expansion has been principally to handle liquified petroleum gas, and such new storage has been constructed mainly by washing out cavities in salt structures. There has, however, been a significant increase in the storage of LPG in mined cavities where there has been a desire to store transportation, as well as product, close to the market. For less volatile hydrocarbons, only significant development is the storage of heating oil in a quarry at Wind Gap, Pa.

Liquefaction

Apparatus for Storing and Utilizing Volatile Hydrocarbons and the Like. W. L. Morrison (assigned to Constock Liquid Methane Corp.) U.S. 2,830,444 (1958) Apr. 15.

In a temperature tank for liquefied methane, comprised of concentric metal walls separated by balsa wood in the annular space, the heat flow through said space is controlled by regulation of vacuum therein, so that sufficient gaseous methane is formed to provide motor fuel for the prime mover.

7. MANUFACTURED GAS AND CHEMICAL PROCESSING

Acetylene

Addition of Ethyl Mercaptan to Acetylenic Compounds. A. T. Blomquist and J. Wolinsky. *J. Organic Chem. 23,* 551 (1958) Apr. (4 pp.)

Free-radical addition of two equivalents of ethyl mercaptan to several acetylenic compounds has been investigated. These comprised propargyl alcohol, propargyl acetate, 2-butyn-1, 4-diol diacetate, 1-hexyne, 2-methyl-3-butyn-2-ol, propiolic acid, dimethyl acetylenedicarboxylate and phenylacetylene. Vicininal *bis*-ethylmercapto derivatives were obtained in all but two instances. Phenylacetylene afforded phenylacetaldehyde diethyl mercaptal while from dimethyl acetylenedicarboxylate only a monoadduct was realized.

Production of Acetylene by High-Speed Catalytic Cracking of Propane. O. V. Kaminskaya, K. P. Lavrovskii and A. M. Brodskii. *Khim. Tekh. Top. Masel 3,* 1 (1958) No. 3 (7 pp. Russian text.)

Propane, propane and methane, and propane and ethylene, were cracked in an externally heated alloy tube filled with coke in laboratory equipment at temperatures from 890°-1150°C and at times of contact in the range 0.007-0.20 sec with water quenching, in order to determine the effect of methane and ethylene as diluents on acetylene production. Both methane and ethylene increased weight conversion of propane to acetylene. Complete gas analyses are given.

J. W. Penney

Aromatics

More Aromatics from Petroleum. J. W. Bradley, R. L. James and R. E. Messing. *Chem. Eng. 65,* 78 (1958) May 5 (3 pp.)

Present slump in steel, which has forced output well under 60% of capacity and trimmed yields of coking chemicals, affords refineries an opportunity to swell oil's share of the benzene-toluene-xylene market. Recovery of BTX from coking is a byproduct operation and limited to level of steel production.

Carbonization

Lignite Carbonization in Saskatchewan. *Can. Chem. Processing 42,* 113 (1958) Apr. (3 pp.)

Progress report on the study being conducted by the Saskatchewan Research Council of low temperature carbonization of lignite coal. Tar fraction was analyzed and economics of a U.S. Bureau of Mines process studied.

Manvers Main. *Gas J. 294,* 75 (1958) Apr. 9 (6 pp.); **Manvers Main Coking and Byproducts Plant.** Part 1. *Coke and Gas 20,* 139 (1958) Apr. (10 pp.); **Largest, Most Modern Coking and By-Products Plant in Country.** *Gas World 147,* (1958) Apr. 12 (7 pp.)

Plant itself does not represent additional carbonizing capacity, but replacement of six separate coke oven plants by one modern plant. It contains one group of 71 Simon-Carves underjet ovens rebuilt as five batteries and a second group of 66 new ovens in two batteries, with total coal throughput of 2890 tons/day. New coal washing and blending plant for four mines and auxiliary handling and byproduct plant are described. Up to 20 million CF/day of gas will be purified and compressed for supplying the East Midlands Gas Board grid.

The Sixth B.C.U.R.A. Coal Science Lecture . . . From Coal to Coke. R. Cheradame. *B.C.U.R.A. Quarterly Gaz.* 1 (1957) No. 33 (12 pp.)

The Director-General of CERCHAR reviews his recent carbonization research for the French coal industry. Studies of coking of Lorraine coals, formation of coke fissures, time-lapse X-ray cinematography of the coking process, blending of inerts and non-fusible coals, the Marienau industrial scale oven station and correlation of results of laboratory, pilot oven and industrial oven tests are discussed.

Catalysts

The Adsorption of Hydrogen on Nickel-Kielselguhr. L. Leibowitz, M. J. D. Low and H. A. Taylor. *J. Phys. Chem. 62,* 471 (1958) Apr. (8 pp.)

Rates of chemisorption of hydrogen on a nickel-kieselguhr surface have been investigated over a pressure range from about 1 cm to 1 atm in the temperature range 160°-325°. Report describes new techniques which demonstrate existence of site production and site of decay, proving the latter to be independent of the prevailing pressure during adsorption. Results are interpreted on the basis of the Taylor-Thon mechanism of chemisorption.

Coal

Comparison of the Thermal Decomposition of the Copper Salts with the Copper-Quinoline Decarboxylation Method. R. S. Montgomery and E. D. Holly. *Fuel 37,* 181 (1958) Apr. (6 pp.)

Copper-quinoline decarboxylation has produced appreciably different results from those of the thermal decomposition of copper salts of the acids obtained by the controlled oxidation of bituminous coal. An investigation was made of both methods to determine their reliability. Quite complete decarboxylation was obtained with the copper-quinoline method while the other method produced only partial decarboxylation.

A Kinetic Study of the Sorption of Oxygen by Two Nova Scotian Coals. F. E. Piercy, D. W. Murray and A. C. Cuthbertson. *Fuel 37,* 129 (1958) Apr. (12 pp.)

Oxidation data obtained from measurements of the sorption of pure oxygen by two Nova Scotia coals are recorded at a temperature of 150°C. The sorption of the oxygen was followed by measuring the diminution of pressure with time while the coal samples were subjected to a tumbling action in the oxidation flask. Gaseous products other than CO_2, SO_2 and water vapor are formed in negligible quantities early in the reaction. Removal of "acid gas" and water vapor makes it possible to measure oxygen pressure in the system at a given time. The energy of activation for the sorption process has been found to be about 21,500 calories.

The Mineral Matter In Coal II—The Composition of the Carbonate Minerals. W. J. S. Pringle and E. Bradburn. *Fuel 37,* 166 (1958) Apr. (15 pp.)

Reassessment of factors on which King, Maries and Crossley base their formulas is being conducted by the Coal Survey Branch of the Scientific Department of the National Coal Board. Article discusses factors compensating for the thermal decomposition of the carbonate minerals. Carbonate minerals in 78 coal samples have been determined. Paper concludes with a review of the composition of ankerite in British coals.

Coal Chemicals

What's Happening to Coal Chemicals? E. C. Medcalf. *Chem. Processing 21,* 37 (1958) May (3 pp.)

While the profit picture for coal-derived products may not be any better in 1958 than in '57, the petrochemical industry is bullish concerning benzene. At least six major oil companies have, or will bring on stream during 1957-58, units to produce benzene, toluene and xylenes. They may find, though, that there is too much capacity for making toluene and xylene.

Coal, Uses

Application of Bonus-Penalty Method to Coal Being Evaluated. R. M. Schahfer, F. H. Strout and G. W. Land. *Coal-Heat 74,* 30 (1958) Apr. (5 pp.)

Relatively simple and accurate method of correcting coal prices on the basis of net worth. When a group of coals is being compared, this same method can be used to determine relative value of these coals on the basis of their net worth rather than the gross heat value as delivered to the plant.

Gasification

Oxygen Production for Lurgi Gasifiers. *Coke and Gas 20,* 158 (1958) Apr. (2 pp.)

High oxygen outputs can be obtained from Morwell plant, which is not only fairly small in size, but also inexpensive to operate. Each of two Linde-Frankl low-temperature air separation units can supply the 102,000 CF of oxygen an hour required for the gas-making process and there is, therefore, always a standby plant. Four 1500 kw five-stage turbo-compressors with a final direct spray cooler have been installed and two have a capacity of about 14 million CF of air/day at 65 psi and atmospheric temperature.

Study of the Kinetics of Carbon Oxidation in Carbon Dioxide and Steam Medium. P. N. Galushko. *Khim. Tekh. Top. Masel 3,* 56 (1958) No. 3 (8 pp. Russian text.)

Rates determined for 15 and 2-5 mm carbon particles (electrode carbon, graphite) in a fixed bed at 800-1050°C. Effect of reactant concentration and pressure studied. Results suitable for industrial engineering calculations.

Assoc. Tech. Services, Inc.

Hydrogen

Study of the Reducing Phase of the Continuous Iron-Steam Method for the Production of Hydro-

gen. A. A. Gavrilova and N. V. Shishakov. *Khim. Tekh. Top. Masel 3,* 63 (1958) No. 3 (8 pp. Russian text.)

Kinetics of reduction of iron oxides (iron ore) with carbon black and semicoke were studied with well-instrumented equipment and effects of the following factors were determined: rate of product removal, concentration of reducing agent, temperature and type of carbon. Reduction with CO in addition to carbon also was studied and process mechanism elucidated.

Assoc. Tech. Services, Inc.

Hydrogen Sulfide Removal

Gas Purification (H_2S Removal) by the Soda-Arsenic Process. V. I. Pankovski and T. I. Kulikova. *Gasovaya Prom.* 19 (1958) 3 (4 pp. Russian text.)

Operating data are given for a soda-arsenic (Thylox) plant operating on gas from underground gasification (CO_2=17.8%). Plant produces brimstone and sodium thiosulfate. Additional thiosulfate produced by reacting sulfur and waste Na_2SO_3 from a phenol plant. Operating data: H_2S inlet, 0.83%; removal efficiency, 87%; gas rate, 22,000 m^3/hr; tar content, 28 mg/m^3; dust content, 3.5 mg/m^3; solution rate, 850 m^3/hr; solution contains 5.0 gpl As_2O_3, 5.6 gpl Na_2CO_3 and 300 gpl $Na_2S_2O_3$; solution temperature, 38°C. Authors conclude that normal solution can be used for high CO_2 gases. Recommendations made to improve efficiency and economy of operation. J. W. Penney

Oil Gas

Studies on Determination of Gas Yields of Oils through Catalytic Cracking in Steam. S. Schubert. *Erdöl u Kohle 11,* 159 (1958) Mar. (2 pp. German text.)

Cracking apparatus of 1-in. quartz tubing with silica gel packing sample and steam generation are described, with gas yield data for several typical oils.

Thetford's New Oil Gas Plant Visited by Gas Engineers. *Gas T. 42,* 37 (1958) Apr. (2 pp.)

New installation is of the Onia-Gegi type and services Thetford and Brandon, some six miles away, via a 2½-in. diam steel main. Present consumption at Thetford is approximately 40 million CF/annum and at Brandon 13 million CF/year. Plant comprises duplicate units of Humphreys & Glasgow's oil gas plant, each having a capacity of 300,000 CF/day.

Typical Application of a Process for the Production of a Low-Cost Gas as a Substitute for Natural Gas. V. Stark. *Gas J. 294,* 135 (1958) Apr. 16 (6 pp.)

Oil gas from autohydrogenation of heavy fuel oils is presented as an interchangeable substitute for natural gas. Economics for base load and peak load conditions, gas vs oil for process heat and extraction of hydrocarbon byproducts are included. (See also *Gas Abstracts 13,* 135.)

Ore Reduction

The R-N Process for Direct Reduction of Iron Ores. *Metal Progress 73,* 73 (1958) Apr. (5 pp.)

Advanced coke reduction kiln process economically produces briquetted iron concentrates which are suitable as feed for blast furnaces, cupolas, open hearths and electric furnaces. It can be used for treating low-grade ore or with high-grade ore to produce metallics. Full-sized plants have been designed and indications are that the combination of an R-N plant with electric furnaces would in many instances be more economical to operate and would involve less investment than a blast furnace-open hearth combination.

Rotary Kiln Enters Iron-Ore-Reduction Race. C. S. Cronan. *Chem. Eng. 65,* 52 (1958) May (3 pp.)

Old-fashioned rotary kiln has stolen a march in the field of solids-gas contacting. New kind of control holds gases at uniform heat. One company has been quietly grooming its rotary kiln process in a 175-ton/day pilot plant near Birmingham. Size of this experiment even dwarfs that of the first commercial fluid-bed direct-reduction unit now being engineered (50 ton/day plant.)

Producer Gas

Co-operation Between Client and Contractor. T. H. Riley. *Gas J. 294,* 142 (1958) Apr. 16 (4 pp.)

Applications of power-gas equipment in gas industry and aid of the client in development of specialty apparatus are discussed.

Pyrolysis

Energy Exchange between Cold Gas Molecules and a Hot Graphite Surface. L. Meyer and R. Gomer, *J. Chem. Phys. 28,* 617 (1958) Apr. (6 pp.)

Methane or ethane do not decompose on clean graphite surfaces up to 2300°C as long as the mean free path of the gas molecules exceeds the dimensions of the reaction cell. This investigation revealed the presence of an accommodation mechanism of temporary adsorption followed by evaporation at critical temperatures essentially independent of the filament temperature as long as the latter is higher than the former. Evaporation temperature for methane is far below its decomposition temperature.

Shale Oil

Thermal Solution of Estonian Enriched Shales. M. K. Dyakova and A. B. Vol-Epshtein. *Khim. i*

Tekh. Top. i Masel 62 (1958) 2 (6 pp. Russian text.)

Based on laboratory work, a process is proposed to convert enriched Estonian shale to motor fuel, chemical products and gas. Process includes thermal solution at 430°C and 30 atm, evaporation, methanol extraction, distillation, hydrogenation and cracking of residue to coke in a moving pellet bed. Yield, based on organic content of enriched shale, to be: gasoline, 19.6%; diesel fuel, 18.8%; phenols, 5.8%; neutral oxygenated compounds, 5.5%; gas, 17.2% (calorific value, 5900 kcal/m^3) and semi-coke, 27.2%. Hydrogen required: 0.34%.

J. W. Penney

Sulfur

Sulphur Production and Acid Recovery Units. *Petrol. 21,* 151 (1958) May (3 pp.)

Two plants for processing effluents have been designed and supplied by Simon-Carves Ltd. for the BP (Kent) Oil Refinery, Isle of Grain. One plant produces elemental sulfur from H_2S and the other, an acid recovery unit, decomposes sludge acid from alkylation and *iso*pentane treatment units and regenerates it as pure H_2SO_4 for reuse in the units. Both processes not only overcome effluent problems but in each case convert the effluent to a useful basic chemical.

Synthesis Gas

Commercial Production of Synthesis Gas from Low Grade Coal. J. A. Linton and G. C. Tisdall. Part 1. **The Gasification Process.** *Coke and Gas 19,* 402 (1957) Oct. (6 pp.); Part 2. **Plant Operation and Byproduct Recovery.** *Ibid.,* 442 (1957) Nov. (6 pp.); Part 3. **Gas Purification.** *Ibid., 20,* 148 (1958) Apr. (6 pp.)

South Africa, where no deposits of natural petroleum have been found, has begun operation of a commercial installation for the production of oil from coal. Entire gasification process is described, from source of coal to wide range of products manufactured.

Carbon Black

After Treatment of Channel Carbon Black. R. E. Dobbin and C. B. Beck (assigned to G. L. Cabot, Inc.) U. S. 2,830,879 (1958) Apr. 15.

Carbon black already deposited on the underside of the usual reciprocating channel-irons in flame impingement zones is treated at high temperatures in the next immediately adjacent zone by air, or lean fuel gas, to improve specific carbon properties.

Process and Apparatus for the Production of Carbon Black. E. Wagner and F. Endter (assigned to Deutsche Gold- and Silber-Scheideanstalt.) U. S. 2,829,951 (1958) Apr. 8.

Improved carbon black process is claimed in which hydrocarbon and oxygen gases are intimately mixed, then burned in a laminar flame.

Catalysts

Synthesis of Hydrogen Cyanide with a Combination Catalyst Body Employing Gauze and Granular Material. G. W. Luckey, J. M. Robinett and A. B. Stiles (assigned to E. I. duPont de Nemours and Co.) U. S. 2,831,752 (1958) Apr. 22.

Hydrogen cyanide is synthesized from ammonia and natural gas over a platinum-coated beryl catalyst whose life is extended by adding a platinum gauze screen on the upstream side of catalyst bed.

Desulfurization

Catalytic Desulphurisation of Petroleum Hydrocarbons with Coke Oven Gas as Source of Hydrogen. F. W. B. Porter and R. P. Northcott (assigned to British Petrol. Co., Ltd.) U. S. 2,830,938 (1958) Apr. 15.

Process comprises continuously supplying a mixture consisting essentially of hydrocarbons and coke-oven gas to a reaction zone, and contacting said mixture therein with a catalyst consisting essentially of the oxides of cobalt and molybdenum incorporated with a support consisting essentially of alumina, at a temperature within the range 650°-850°F and at a superatmospheric pressure up to 1500 psi.

Gasification

Gasification of Sulfur-Bearing Carbonaceous Fuels. Du B. Eastman (assigned to Texas Co.) U. S. 2,830,883 (1958) Apr. 15.

Solid carbonaceous fuel is reacted with an oxygen-containing gas at a temperature in the range of 2200°-3200°F to produce mainly carbon monoxide together with some carbon dioxide and hydrogen.

Method for Production of Carbon Monoxide from Solid Fuels. C. R. Carkeek (assigned to the Texas Co.) U. S. 2,829,957 (1958) Apr. 8.

Preheated steam-coal suspension is injected into a vortex chamber and the swirling stream discharged axially into an enlarged reaction zone with free oxygen in proportions to form carbon monoxide and hydrogen. Excess suspension steam may be recovered at top of vortex chamber.

Oil Gas

Catalytic Treatment of Sulfur-Contaminated Hydrocarbons for the Production of Hydrogen. J. H. Shapleigh (assigned to Hercules Powder Co.) U. S. 2,830,880 (1958) Apr. 15.

Process which is claimed to minimize chemical poisoning of nickel catalyst by sulfur and carbon comprises passing a mixture of steam and a fluid hydrocarbon through an externally heated reaction zone maintained at a temperature of 900°-2000°F to produce a partially cracked mixture, and passing the hydrogen containing effluent over a nickel catalyst at point of initial contact to substantially crack the remaining hydrocarbon.

Manufacture of Combustible Gases. K. Ruschin and G. Milner (assigned to Power-Gas Corp. Ltd.) U. S. 2,829,034 (1958) Apr. 1.

Cyclic regenerative process is claimed for producing a utility gas from heavy hydrocarbon oil, which utilizes a four-zone heat and make system. Oil is vaporized in steam and then is passed to a catalyst zone. Heat is recovered from refractory packings in initial and final heating zones.

Method of Producing Combustible Gas Rich in Oil Gas. C. B. Glover and C. Gordon (assigned to United Gas Improvement Co.) U. S. 2,828,196 (1958) Mar. 25.

Cyclic method is claimed for producing a combustible gas rich in oil gas which comprises passing vaporized liquid petroleum and steam (0.8-3.0 steam/lb carbon in oil) into a 1400°F bed of nickel-coated refractory and at oil feed rates to give a value of 3:6 for the ratio of lb carbon/hour to sq ft surface × lb nickel/100 sq ft surface. After a 100° temperature drop, the carbon is burned off by hot oxygenated blast, purged and reduced by initial portion of make-run.

Process for Conversion of Liquid Hydrocarbons in Horizontal Chamber Ovens. C. Hahn (assigned to Koppers Co., Inc.) U. S. 2,829,956 (1958) Apr. 8.

Oils and liquid residues are converted to gas and coke by a double-charging procedure in a coke oven with the first-stage charge through the top charging holes nearest the doors of regular coking coal, and the second-stage charge through the central holes with oil-soaked coke up to normal charge load.

Ore Reduction

Apparatus and Method for Producing Sponge Iron. W. H. Osborn (assigned to Phelps Dodge Corp.) U. S. 2,831,759 (1958) Apr. 22.

Iron oxides preheated in a kiln are fed to a fluidized bed in which heat is maintained by a gas heated muffles in the bed and reduction is achieved by natural gas used to fluidize. Off gases from over the fluid bed are passed to heat exchangers to preheat combustion air, cleaned and recycled with compressed fluidizing gas for reduction.

Furnacing Process. O. Moklebust (assigned to National Lead Co.) U. S. 2,829,042 (1958) Apr. 1.

In a horizontal rotary kiln for iron ore reduction, the heat required, which is introduced at the discharge end burner, is extended more uniformly toward the feed end by admitting controlled amounts of air or oxygen along the kiln to burn the carbon monoxide.

Process of Treating Low Grade Iron Ores. W. E. Greenawalt. U. S. 2,829,043 (1958) Apr. 1.

Finely ground ore middlings are showered through the hot atmospheres of a melting furnace, molten dust separated, the gas separated and the unreduced middling granulated and smelted in a carbon column furnace.

Synthesis Gas

Production of Nitrogen and Hydrogen for Ammonia Synthesis. M. J. Barry and T. S. Williams (assigned to M. W. Kellogg Co.) U. S. 2,829,119 (1958) Apr. 1.

Hydrocarbons, preferably natural gas, are reformed with steam at 1250°-1450°F and 125 psig in a first zone of Group 8 catalyst, then reacted at 1500°-1900°F and 125 psig with steam and air in a second catalyst zone to yield properly proportioned hydrogen-nitrogen mixtures for ammonia synthesis.

8. GAS DISTRIBUTION

Canadian Gas Load

Load-Building Campaigns Boost Ontario-Quebec Gas Sales. *World Petrol. 29,* 98 (1958) May (2 pp.)

Anticipating arrival of western gas in another year, distributors in the Ontario-Quebec region are engaged in a load-building campaign which is centered in the metropolitan areas of Toronto and Montreal. Union Gas Co. has built a 26-in. line across Ontario; Trans-Canada has built a 20-in. line from Toronto to Montreal and Quebec Natural Gas Corp., now converting its customers' appliances from manufactured to natural gas, has laid a 16- to 20-in. central main across Montreal island.

Distribution Systems

Gas for Gotham. W. W. Clark. *Gas 34,* 55 (1958) May (14 pp.)

Description of the New York gas supply situation as it existed in 1950, before the advent of natural gas, in 1951, when natural gas was introduced via the Transcontinental GPL Corp. lines, and a review of the gradual area-wide adoption of natural gas as told in terms of the efforts of the three major companies: Consolidated Edison, Brooklyn Union and Long Island Lighting. General market potential, great expansion of demand for house heating, efforts

to assure a firm supply, the main piping and dispatching network and standby manufacturing plants are briefly reviewed.

How to Plan New Gas Distribution Systems. T. L. Mitchell. *Am. Gas J. 185,* 29 (1958) May (4 pp.)

Iowa Public Service Co. uses six major sections in determining how the actual design of the integral parts of a gas distribution system are concerned: mains, odorization, pumping and regulating, services, regulators—customer, and meters.

Next 10 Years in Distribution Expenses. W. B. Tippy. *Gas Age 121,* 13 (1958) Apr. 17 (6 pp.)

Maintenance per meter will double, from $3.75 to $7.50; operation will increase to $7.75 a meter; office expense may also double to $4.00 per meter. Rigid control of manpower is a requirement.

Maintenance

Better Rigs Spark Advancements in Bituminous Paving. *Construction Methods and Equipment 40,* 113 (1958) Apr. (8 pp.)

Based on a speech by J. A. Radzikowski, article summarizes advances in equipment and techniques applicable to the bituminous paving field. Touches on compaction machinery and methods, automation of asphalt plants and improvement in rate of laying down material. Result: contractors are now placing an average of 15,000 miles of high-type bituminous pavement annually.

Preventing Damage of Gas Facilities by Foreign Sources. S. Sokolow. *Gas 34,* 71 (1958) May 4 (4 pp.)

Gas distributor is faced with problem of danger to gas mains and services by street improvement work, installation of storm drains, sewers, water mains, oil lines, electric and phone conduits, power poles, etc. Solution is likely to be costly; yet problem is welcome because it represents progress and prosperity in the form of improved cities, with more and better utilities to serve the public.

Metering

Eliminating Noise at Gas Meter Stations. R. C. Lisk. *Instruments and Automation 31,* 661 (1958) Apr. (3 pp.)

Identification and elimination of noise-producing vibration at pipeline terminals pays off in longer equipment life, improved employee performance and better public relations.

Meter Standardization Aids Costs. J. Webb. *A.G.A. Monthly 40,* 33 (1958) Apr. (2 pp.); **Purchase Specs for Small Diaphragm Meters Provide Standardization Tool.** J. Webb. *Gas Age 121,* 46 (1958) May 1 (2 pp.)

A.G.A. Board approves standard purchase specifications for small diaphragm-type gas meter without limiting manufacturer with regard to style, appearance, materials or methods of assembly.

Outdoor vs Indoor Meter Settings in Northern Climates. L. C. Rohret. *Am. Gas J. 185,* 24 (1958) May (2 pp.)

Studies indicate that gas meters may be set out-of-doors in rigorous climates, and if small differentials between indoor and outdoor readings are recognized and compensated for, the result would be no increase in cost of service being rendered to the customer. Company would realize a saving in meter reading costs.

Washington Streamlines Its Meter Shop. *Gas Age 121,* 17 (1958) Apr. 17 (4 pp.)

Three-part streamlining program includes remodeling floor in the service building, rearrangement of work stations to set up an efficient flow-line system and addition of new equipment, including conveyor systems, pallets and a fork lift truck, to reduce manual handling.

Weather Prediction

How Good Is Really Cold Weather for a Gas Company? *Am. Gas J. 185,* 26 (1958) May (2 pp.)

Experiences of Laclede Gas Co., St. Louis, indicate that unusually cold weather can be as costly as a very mild winter. Best gas sales weather occurs when gas load is such that full deliverability of pipelines is being utilized. For Laclede, during the past winter, this meant average temperatures of 32°-36°F.

What February's Cold Wave Revealed. *Gas Age 121,* 19 (1958) May 1 (17 pp.)

Winter heating season was one of the most severe in decades. It was also first major test for gas industry since gas became the No. 1 heating fuel of the nation. Some 30 companies in 19 states participated in a survey that asked questions such as: What happened in two-thirds of the country seriously affected in January and February? On the basis of a severe winter, continuing through a "nor'easter," what plans have gas companies made to assure service to all customers in the years to come? Answers may be of value to all gas companies.

9. GAS FUEL UTILIZATION AND APPLIANCES

Air Conditioning

Automatic Control of Primary Air Units for Induction Air-Conditioning Systems. N. J. Janisse and

R. G. Weeks. *Air Conditioning, Heating and Ventilating 55,* 69 (1958) May (7 pp.)

Induction air conditioning system is described and functions of its components outlined, after which methods of control are discussed. Typical complete system is presented and its operation detailed. While examples presented are those involving application of pneumatic controls, the principles apply equally to other types of air-conditioning controls.

Dehumidification Serves Comfort Air Conditioning. T. F. Rockwell and J. A. Sheahan. *Heating, Piping & Air Conditioning 30,* 115 (1958) May (4 pp.)

Fundamentals of design, installation and operation are presented and illustrated by one example. Performance tests demonstrate how local conditions made sorbent type dehumidification pay off.

Air Pollution

Fourth Technical Progress Report. W. L. Faith, N. A. Renzetti and L. H. Rogers. Air Pollution Foundation Report No. 22, San Marino, Calif., 1958. (Mar.)

Report of Foundation's efforts to determine more accurately the nature of the auto exhaust-smog reaction and to determine ways of adequately and economically controlling auto exhaust. The Foundation is supporting research at Standford Research Institute with a 520 cu ft irradiation chamber on smog effects, of varying amounts and kinds of exhaust, of different cars, of varying irradiation time and of different fuels. Irradiation of diluted auto exhaust (2550 ppm in purified air), even with lead aerosol removed by glass fiber filtration, produces copious numbers of particles in the range 0.2-0.5 microns in diameter. Control of automobile exhaust in the Los Angeles basin will cost approximately $150-$250 million annually, based on 3 million automobiles.

Kinetic Studies of Formation of Atmospheric Oxidants. B. E. Saltzman. *Ind. Eng. Chem. 50,* 677 (1958) Apr. (6 pp.)

Kinetic studies were conducted to clarify the mechanisms of oxidative smog formation and the roles of various pollutants. Calculations of the kinetic balance of inorganic reactions suggest that only a small fraction of "oxidant" may be ozone and that, during smog peaks, "nitric oxide" indicated on recorders may be free radical-nitric oxide complexes. Mass spectrographic and chemical investigations indicated that ozone-l-hexane reaction is much faster than previously reported.

Burners

Dimensioning of Atmospheric Burners of the Bunsen Type. E. Guman. *Rivista dei Combustibili 12,* 79 (1958) Feb. (20 pp. Italian text.)

Mathematical discussion on problem of entrainment of primary air produced by fuel gas expelled under pressure from the nozzle. Equations employed express the kinetic energy in various sections of a burner; loss by impact is evaluated using the Borda-Carnot equation. Formulas have been derived for easy determination of burner size when air/gas ratio is known.

Use of Low Calorific Value Gas for Domestic Gas Supply. M. A. Volkov. *Gasovaya Prom.* 38 (1958) 1 (5 pp. Russian text.)

Design data and test results given for a special design of top burner operating on low calorific value gas such as obtained from underground gasification of coal. Special burner uses the principle of surface combustion and has a ceramic head with 127 ports, 6-mm diameter and 12-16 deep. Operation on a gas of 1183 kcal/m^3 at a rate of 1562 kcal/hr resulted in an efficiency of 65-70%, with a CO content less than the All-State Standard of 0.02% (dry basis). J. W. Penney

Clothes Dryers

Dryer Controls that Slide Out. *Appliance Manufacturer 6,* 61 (1958) Apr.

Desire for standardization led one manufacturer to a new burner, venturi-type, which is grouped with its controls on a slide-out panel. Burner control unit simplifies fabrication, testing and assembly, speeds servicing and eliminates inventory problems for dealers. It is used with both constant burning and electric ignition pilots in the company's 1958 dryer line.

Firm Faith and the Combomatic. *Appliance Manufacturer 6,* 41 (1958) Apr. (3 pp.)

One manufacturer believes that washer-dryer sales for 1963 will lead the field for automatic washers in the same way that automatics topped conventional models in 1952. This company has designed a compact unit as the spearhead of an all-out campaign. An under-the-counter model is being made in addition.

Drying

New Finishing System Aids Expansion Program. *Ind. Gas 36,* 12 (1958) Apr. (2 pp.)

Office furniture manufacturer installs gas ovens at second plant and plans similar system at third location. System is planned to provide maximum production with minimum manpower and to conserve floor space.

Flame Research

The Ignition of Combustible Gases by Flames. H. G. Wolfhard and D. S. Burgess. *Combustion and Flame 2,* 3 (1958) Mar. (10 pp.)

Ignition of a stoichiometric methane-nitric oxide mixture by stationary pilot flames has been studied. These pilot flames can be burned indefinitely in the surrounding explosive mixture without causing ignition if the temperature or mass flow of the pilot is insufficient. For very small pilot flames the condition for ignition is a minimum energy flow (cal/s), whereas for large pilots a minimum temperature is necessary. This minimum ignition temperature is little related to the spontaneous ignition temperature. Ignition occurs at the end of a luminous reacting column in which reaction rates, diffusion processes and heat conduction are the determining processes.

The Methyl Nitrite Decomposition in Flame. E. A. Arden and J. Powling. *Combustion and Flame 2,* 55 (1958) Mar. (14 pp.)

Methyl nitrite decomposition flame has been investigated at atmospheric pressure. Course of reaction has been followed through a flat flame by measuring changes in gas composition and temperature. Burning velocity of the decomposition flame relative to vapor at 200°C was 7.3 cm/s and maximum temperature attained was about 1100°C. Nitrite first decomposes thermoneutrally to nitric oxide, methanol and formaldehyde and subsequent exothermic reaction takes place in these products. Reaction does not go to completion, however, the reduction of nitric oxide decreasing when the decomposition of methanol and formaldehyde is complete.

Reaction Kinetics, Thermodynamics, and Transport in the Hydrogen-Bromine System. A Survey of Properties for Flame Studies. E. S. Campbell and R. M. Fristrom. *Chem. Rev. 58,* 173 (1958) Apr. (62 pp.)

Assimilation and evaluation of best available data on flame theory and experimental techniques to aid in direct comparison of theory and experiment. Theoretical calculations on the hydrogen-bromine flame using currently available data are important primarily as mathematical experiments, to discover the significance of various physical processes within the flame. Recommendations for more precise experimental studies of high-temperature kinetic and transport properties are made, as a basis for the necessary detailed comparison of theory with experiment.

Review of Some Unusual Stationary Flame Reactions. W. G. Parker. *Combustion and Flame 2,* 69 (1958) Mar. (12 pp.)

Air flames, because of their wide applications, have dominated combustion research to date. Brief review indicates that self-propagating flames are not confined to oxidation reactions by oxygen or even to oxidation reactions in the broadest sense.

Furnaces

Firing Practice: Natural Gas Replaces Steam. J. E. Goodin and V. B. Thompson. *J. Metals 10,* 272 (1958) Apr. (2 pp.)

Two plants report on atomizing liquid fuel with natural gas rather than with steam. In both cases results are higher production and better over-all operation.

Gas Turbines

Gas Turbines—Their Design Future. *Product Eng. 29,* 22 (1958) May 5 (3 pp.)

Beyond the aircraft field, the small gas turbine has found a multitude of uses that promise a big future. To date, automotive applications are considered the biggest field. One motor company's newly developed, low-cost turbine is a real breakthrough. Expensive development programs force many aircraft gas turbine manufacturers to develop other uses for an aircraft-type engine.

Incinerators

Design of Domestic Gas-Fired Incinerators for Elimination of Smoke, Odors, and Fly Ash. D. W. Skipworth, G. M. Hein and H. W. Nelson. American Gas Association Laboratories Research Bulletin 78. Cleveland: The Association Laboratories, April 1958.

Design of prototype domestic gas-fired incinerators was studied by Battelle Memorial Institute and the American Gas Association Laboratories, after a survey of existing commercial incinerators. Major factors of design included: 1) cooling of jacket and flue gases; 2) combustion air supply for initial and after burning; 3) odor destruction by gas-fired after burner; 4) removal of fly ash; 5) draft control by barometric damper; 6) ash storage capacity and 7) ready access to burners and controls. Results of above studies and of performance tests are presented. New incinerator designs developed by five manufacturers for marketing in 1958 also are discussed.

Industrial Heating

Automatic Brazing Speeds Making of Coils for Carrier Corp. H. E. Miller. *Ind. Gas 36,* 6 (1958) Apr. (3 pp.)

Fast running press, automatic gas brazing machine and hydraulic expander combine to increase production and reduce labor and rejects.

How to Design for Radiant Heating II. L. M. Polentz. *Chem. Eng. 65,* 151 (1958) Apr. (4 pp.)

No matter which radiant heat source is selected, key to best design is still 1) amount of wavelength energy emitted (rather than at what temperature),

2) amount of radiation actually absorbed and 3) cost.

Largest One-Story Coffee Plant Opens in Los Angeles. J. Joseph. *Ind. Gas 36,* 2 (1958) Apr. (4 pp.)

Each roaster in this new facility is rated at 8000 CF of gas hourly, the plant's total monthly gas usage approximating 3,200,000 CF (including some 1000 CF hourly used in each of two smoke burners and 1100 CF in a chaff incinerator. Plant will process 144,000 lb of coffee daily; one-story flow depends on conveyors and elevators, not gravity.

Motor Fuel

Needed—Motor Fuel Standards for LPG. C. Abell. *Butane-Propane News 20,* 107 (1958) May (7 pp.)

In recent months, the number of complaints about the efficiency of propane as a motor fuel has made the situation critical. Much data are available, but industry does not know enough about the relationships. Motor fuel standards would enable correction of present difficulties and future progress in carburetion field.

Ore Reduction

Carbon Monoxide Reduction of Iron Ore. O. Stelling. *J. Metals 10,* 290 (1958) Apr. (6 pp.)

New nonmelting reduction process claims many advantages over previously reported sponge iron process; it is a continuous direct-reduction process which employs carbon monoxide in a fluidized bed.

Refrigerators

High Capacity Low Temperature Refrigeration. J. R. Harnish and N. E. Hopkins. *Chem. Eng. Progress 54,* 82 (1958) Apr. (5 pp.)

Description of 1) design characteristics of a custom-built refrigeration unit which operates under widely varying temperatures and 2) of the cooling capacity requirements. Unit employs a cascade refrigerant system.

Service, Customers

Don't Be Hasty with 'Leakers'. A. Perron. *Gas Heat and Comfort Cooling 9,* 31 (1958) May (2 pp.)

Author's experience in servicing of water heaters, unit heaters and central heating enables him to offer suggestions profitable to all levels of the industry.

Space Heating

Prefab Homes—Heating Profits in the New Building Business? O. Shaftel. *Gas Heat and Comfort Cooling 9,* 25 (1958) May (3 pp.)

Builder predicts that heating contractor will last longer in prefab field than skilled cabinet maker or door hanger because prefab homes demand one thing that manufacturers and wholesalers can't offer builders: responsibility for installation and service.

Heat Gain Through Windows Shaded by Canvas Awnings. N. Ozisik and L. F. Schutrum. *Heating, Piping & Air Conditioning 30,* 159 (1958) May (8 pp.)

Results of analytical and experimental investigation on heat gain through glass windows shaded by canvas awnings recognize material, color, shape and venting of awnings as important factors. Each factor was evaluated and experimental results are in satisfactory agreement with the calculated values.

Infra-red Heating Gains Acceptance. D. S. Smith. *Can Gas J. 51,* 15 (1958) Apr. (3 pp.)

Applications of radiant gas burners for space and industrial heating are discussed.

Water Heaters

Automatic Water Heating Speeds Rug Cleaning. *Ind. Gas 36,* 9 (1958) Apr.

Multicoil automatic gas water heater maintains correct temperature to help Cincinnati plant increase its capacity to 35 rugs per hour while reducing major costs by approximately 25%.

Burners

Gaseous Fuel Burner for Curved Combustion Chambers. N. G. Campbell and C. A. Reichelderfer (assigned to Norman Products Co.) U. S. 2,829,708 (1958) Apr. 8.

To avoid localized heating and impingement on chamber walls in an annular combustion chamber, a burner is claimed comprising a chamber fed by gas and air inserted directly in the annulus, said chamber having two arcuate, concave walls with multiple flame orifices facing opposite each other in the annulus, each focusing the burning gases to avoid the walls.

Method for Constructing Parallel Slot Gas Burner. R. R. Taylor (assigned to Fraser & Johnston Co.) U. S. 2,828,532 (1958) Apr. 1.

Sheet metal burners with parallel slot ports are improved by prepunching and threading the sides and inner slot-spacer strips and fastening the assembly with screws to maintain exact port width.

Flame Research

Process and Apparatus for Determining the Combustible Character of Gases. J. J. Webber (assigned to Owens-Corning Fiberglas Corp.) U. S. 2,829,952 (1958) Apr. 8.

Improved gas analyzer is claimed which uses a

burner to establish the oxidizing or reducing quality of the gas sample, adding known amounts of a component gas to obtain complete combustion and observing the effects of combustion gases upon color of a copper surface.

Furnaces

Gas-Fueled Heating Apparatus. A. F. Holden. U. S. 2,828,813 (1958) Apr. 1.

Porous wall, internal combustion furnace burning a gas-air mixture from pressure jackets is improved by drilling 1-in. holes partly through from the outer side of the porous wall, in a pattern designed to obtain uniform wall combustion.

Pilot Lights

Low Input Pilot Burner. R. B. Larkin, Jr. (assigned to Patrol Valve Co.) U. S. 2,828,814 (1958) Apr. 1.

Platinum, nickel or chromium wire of 0.013-0.030-in. diam is claimed as a stabilizer for a low input pilot burner by inserting the wire in the burner port opening so as to project just above the flame.

10. EQUIPMENT AND INSTRUMENTATION

Computer Systems

Computer Use in Pilot Plant Calculations. L. S. Stanton, E. B. Reid and H. F. Mason. *Ind. Eng. Chem. 50,* 719 (1958) May (2 pp.)

Computer program has been developed to employ process data from a catalyst-testing pilot plant with a great saving in time. Program features editing and review of raw run sheet data prior to and during their processing. Some of this can be effected automatically.

Engineering Design on a Computer. E. J. Higgins, J. W. Kellett and L. T. Ung. *Ind. Eng. Chem. 50,* 712 (1958) May (7 pp.)

Engineering design improvements may effect million-dollar savings where a large computer unit can be optimized as a whole, or less savings where programs cover only portions of the design. Computers are used increasingly to improve designs rather than to save large amounts of manpower or elapsed time. They are of great value in engineering work, if well-planned programs are developed by engineering experts.

Use of Computers in Reactors Design. D. S. Billingsley, W. S. McLaughlin, Jr., N. E. Welch and C. D. Holland. *Ind. Eng. Chem. 50,* 741 (1958) May (12 pp.)

Tedious stepwise calculations are involved in the design for liquid phase, first-order endothermic reactions carried out in either batch or flow-type tubular reactors heated by condensing vapors. To eliminate this cumbersome task, a set of nomographs has been designed on the basis of solutions obtained with an IBM 650 digital computer. An analytical treatment of certain special cases has been developed.

Furnaces

Efficient Use of Fuel for Melting and Thermal Treatment of Metals. *Ind. Gas (British)* 21, 12 (1958) Apr. (3 pp.)

Automatic and accurate control of the air/gas ratio is important from a fuel economy standpoint. One method of achieving this is the substitution of insulating refractory linings, in conjunction with the employment of air/gas proportioning burner equipment with correct design. Examples of savings on a reverbatory holding furnace and on hot brass stamping furnaces are cited.

Instruments

Trends in Radiation Instrumentation. J. B. Williams. *Instruments and Automation 31,* 624 (1958) Apr. (6 pp.)

Summary of the operation of basic radiation detectors and instruments, the improved circuitry incorporated in the newer equipments and trends in the field.

Maintenance

How to Find Microscopic Leaks in Process Equipment. P. Winter, H. R. Bilford, C. E. Jacob and R. A. Kemmerer. *Ind. Eng. Chem. 50,* 53A (1958) May (3 pp.)

Seven methods are available for detecting microscopic leaks in equipment. Some may be suitable and capable of doing a job quickly; others may not be applicable in the same case. Included are four devices (Halide Leak Detector, Halide Torch, helium mass spectrometer and infrared leak detector) and three methods (dye penetration, radioactive tracer methods and chemical reactions.)

Pilot Plants

Equipment for Miniature Pilot Plants. C. H. Stockman and R. E. Lynn, Jr. *Ind. Eng. Chem. 50,* 585 (1958) Apr. (6 pp.)

Gathering engineering data on a small scale generally requires the construction of a miniature pilot plant. Description of some useful items of equipment, commercially available, includes pumps, flowmeters, distillation and extraction equipment, powder feeders, centrifuges and filters, reactors, mixers and piping. Typical miniature pilot plant is illustrated.

Pipeline Operation

Gilsonite Line Marks First Year of Operation. J. H. Henderson, Jr. *Pipe Line Ind. 8,* 61 (1958) Apr. (5 pp.)

Operating experience confirms findings of advance research on slurry flow and pumping problems. Out-of-pocket expense of handling 170,000 tons of crushed gilsonite has been only 2.5 cents/mile.

Pressure Regulation

Self-Actuated Pressure Regulators. G. W. Gale. *Control Eng. 5,* 124 (1958) May (5 pp.)

Simple, fast responding, easy to maintain and low-cost, self-actuated pressure regulators are suitable as moderately accurate pressure controllers. Satisfactory operation requires knowledge of functional and constructional characteristics. Article clearly defines basic variations with major emphasis on application information.

Pyrometer

A Recording Sodium-Line Reversal Pyrometer. W. M. Brobeck, R. E. Clemensen and W. E. Voreck. *Jet Propulsion 28,* 249 (1958) Apr. (4 pp.)

Description of instrument for measurement of flame temperatures from 1500°-2700°C by the sodium-line reversal method in which a trained operator is replaced by a closed-loop electromechanical system. Advantages are in continuous recording of varying flame temperatures, increased accuracy and measurement on flames that would be dangerous to an observer.

Steam Generation

Steam Boiler Plant Modernized. F. M. Reiter, *Air Conditioning, Heating and Ventilating 55,* 78 (1958) May (3 pp.)

Masonic Temple, Dayton, Ohio, was originally equipped with coal-burning, stoker-fed steam boilers. Changes were made to gas and later to oil-fired burners. Boiler room now has six package-type steam boilers. The ones used for space heating burn oil or gas, depending on outside temperatures.

Calorimetry

Apparatus for Analyzing Gas. W. H. Dailey, Jr. and J. W. Carter (assigned to Surface Combustion Corp.) U. S. 2,829,954 (1958) Apr. 8.

Device is claimed for determining heating value of gases, comprising a sampling line with eliminators for free moisture and dust, with heated filters for passing gas at a controlled temperature above dew-point, operating at a reduced pressure.

11. MATERIALS OF CONSTRUCTION, AND CORROSION

Cathodic Protection

Cathodic Protection for Earth-Buried Pipelines and Other Metal Structures. J. H. Bird and A. Z. Dimitroff. Washington, D.C.: *U.S. Bur. of Mines Inf. Circ.* 7827 (1958) Apr.

Discussion of grounding mediums and phases of grounding related to corrosion and cathodic protection. Material indicates more effective methods of reducing corrosion damage to metal structures and equipment in the mining industry by cathodic protection. General principles of this method of inhibiting corrosion are presented. Relationship between soil resistivity, protective grounding and corrosion is presented.

Ceramics

Alumina-Type Cermets. *Ceramics 9,* 22 (1958) Apr. (4 pp.)

New cermets offer high temperature strength, erosion and wear resistance, oxidation resistance and resistance to molten metals. Limitations: relative brittleness, which restricts their use in carburizing atmospheres and under high stress or mechanical shock conditions. They are not recommended for use in molten aluminum or in acid and carbide slags.

High-Temperature Nonmetallics. R. W. Brown. *Chem. Eng. 65,* 135 (1958) Apr. (16 pp.)

Comprehensive roundup of materials of construction is designed to advise reader on design and application problems. Article is confined to materials that work best between 1500°-3500°F. Emphasis is on engineering characteristics, good and bad, of the materials now available to the chemical engineer.

New Developments in Ceramics. J. H. Koenig. *Materials in Design Eng. 47,* 121 (1958) May (16 pp.)

Properties, developments and new ceramic materials are grouped by electrical, mechanical, high temperature cermet and nuclear applications.

Coatings

"Hypalon" Coatings. H. J. Lanning. *Corrosion Tech. 5,* 110 (1958) Apr. (5 pp.)

It has only been a few years since Hypalon, a chloroshulphonated polyethylene, has been introduced on the American markets. Initially, a large proportion went into coatings. Currently, a full-scale plant of 15 million pounds per year is on operation. Details of its composition are given.

Protection of Structural Steelwork in Chemical Plant. M. Waghorn. *Corrosion Tech. 5,* 103 (1958) Apr. (4 pp.)

Primary objective in coating the structure and equipment in chemical plants is to protect the considerable capital investment involved. Two other reasons follow: protection of the product from contamination and improvement of working conditions.

Thin-Film Coatings Finding Greater Use on Pipelines. D. H. Stormont. *Oil Gas J. 56,* 135 (1958) May 12.

Use of coal tar-epoxy resin coatings still poses problems in pipeline protection, but over-all results so far have been excellent. About 200 miles of pipe have been coated with these compounds since 1953, the bulk of the work having been done within the past year.

Corrosion Prevention

Hydrogen Behavior of Metals—A Factor in Selection of Metals for Equipment Fabrication. G. P. K. Chu. *Ind. Eng. Chem. 50,* 59A (1958) May (2 pp.)

Hydrogen absorbed in steel can later cause coatings on equipment to blister or chip. Mild steel, after controlling processing steps, such as proper heat treatment, surface alloying, protective atmospheric firing and cooling, can be used with great assurance.

Inhibitors

Vapour-Phase Corrosion Inhibitors. S. Rowden. *Corrosion Tech. 5,* 117 (1958) Apr. (6 pp.)

Relatively recent development in the field of corrosion prevention has been the advent of the volatile inhibitor, although it can be said that inhibition may occur when the normally volatile inhibitor is in the solid or gaseous state. Inhibitors are chemical substances which will reduce the intensity of the anodic or cathodic reactions. There are three principal classes of organic substances which fulfill the requirements of a vapor-phase corrosion inhibitor: amines and other nitrites, esters of carboxyl acid and amine carbonates.

Welding

Ultrasonic Welding—A New Technique Grows. J. B. Jones. *Metal Progress 73,* 68 (1958) Apr. (5 pp.)

Ultrasonic welding joins similar or dissimilar metals by introducing vibrational energy into the area to be united. Sold-state metallurgical bonds, comparable in strength to those resulting from conventional methods, are produced. Thin gages, even in high-temperature, corrosion resistant metals, are easily welded.

Coatings

Apparatus for Applying Reinforcing Fibrous Material to a Plastic Pipe. A. W. Pazan. U. S. 2,829,699 (1958) Apr. 8.

Plastic pipe of any desirable strength is produced by an extrusion machine, with subsequent reaction which wraps the pipe with hot resin containing reinforcing fiber glass.

Inhibitors

Process for Inhibiting Corrosion by Carbon Dioxide in Alkylol Amine Systems. H. R. Froning and R. L. Langworthy (assigned to Pan American Petroleum Corp.) U. S. 2,826,516 (1958) Mar. 11.

Carbon dioxide corrosion of ferrous metal equipment is inhibited in alkylol amine scrubbing processes for CO_2 removal by supplying silica in soluble form to said solution.

12. ANALYTICAL METHODS AND TESTS

Analytical Instruments

Nuclear Magnetic Resonance Spectrometry. C. A. Reilly. *Anal. Chem. 30,* 839 (1958) Apr. (10 pp.)

Review comprises an outline of aspects of nuclear magnetic resonance spectroscopy that have a bearing on chemical analysis, together with a critical evaluation of the status of the method as an analytical tool. No attempt is made to cover completely all the analytical applications that have been made.

Ultraviolet Spectrophotometry. R. C. Hirt. *Anal. Chem. 30,* 589 (1958) Apr. (4 pp.)

Selective biennial review covers the period from the last review on ultraviolet spectrophotometry until about the end of October, 1957. Spectra published in connection with structural studies, the characteristizations of compounds and the kinetics of reactions are not included.

Chromatography

Chromatographic Examination of Industrial Gases by Means of a Semi-Automatic Apparatus Located at Test Laboratory No. II of the Parisian Gas Group. H. Dumay. *J. Usines a Gaz 82,* 107 (1958) Mar. (8 pp. French text.)

Apparatus, sampling and operating techniques using a CO_2-sweep gas with activated carbon column are described for all types of industrial gases.

Chromatography. Analysis by Differential Migration. H. H. Strain. *Anal. Chem. 30,* 620 (1958) Apr. (10 pp.)

During the two-year interim since the last review, the field of chromatography has been divided into two major divisions: gas chromatography and solution chromatography. Some of the techniques, such as gas chromatography, continuous electrochromatography and mass spectrometry have been standardized and instrumentized so that they may be employed by operators of limited experience. There have been remarkable developments in the refinement and application of all the differential migration methods of analysis.

Chromatography Has Become a Valuable Tool as a Guide to Fractionator Operation. A. B. Altom. *Oil Gas J. 56,* 122 (1958) Apr. 21.

Many control tests such as vapor pressure, distillation and weathering have been completely eliminated by use of the chromatograph.

Chromatograph Has Quick Payout at Snyder Plant. B. Denny. *Oil Gas J. 56,* 117 (1958) Apr. 21 (2 pp.)

Stream analyzer results in propane-recovery increase which, in one month, resulted in a gain of $10,500, or more than twice the cost of the equipment.

Chromatography Is a Plant Workhorse. J. F. Hickerson. *Oil Gas J. 56,* 119 (1958) Apr. 21 (2 pp.)

Humble's Baytown refinery laboratory analyzes about 2000 samples each month. Automatic attenuators save manpower.

Determination of Traces of Oxygen, Carbon Monoxide, Methane and Nitrogen Content in Pure Ethylene by Adsorption Chromatography. H. Pietsch. *Erdöl u Kohle 11,* 157 (1958) Mar. (3 pp. German text.)

By use of "silica gel 923" and Linde "molecular sieves 4A and 5A," traces of impurities are adsorbed and concentrated to permit quantitative determination on the Perkin-Elmer Fractometer Model 154.

Here's How Gas Chromatography Works in the Laboratory. L. N. Locke. *Oil Gas J. 56,* 120 (1958) Apr. 21 (2 pp.)

Valuable adjunct in analytical techniques, the chromatography instrument is reliable and fast. One company reports successful operation of units in analyzing light components in refinery streams.

High Temperature Gas Chromatography Apparatus. S. Dal Nogare and L. W. Safranski. *Anal. Chem. 30,* 894 (1958) May (5 pp.)

Relatively simple, high temperature gas chromatographic apparatus is used for qualitative and quantitative resolution and estimation of high-boiling organic mixtures. High vacuum silicone grease and commercial linear polyethylene are used as partition media in temperature range 150°-350°C. Separations of high-boiling hydrocarbon mixtures are particularly successful.

Monitoring and Control with Automatic Chromatographic Analyzers. M. M. Fourroux. *Oil Gas J. 56,* 114 (1958) Apr. 21 (3 pp.)

December, 1957, witnessed the successful completion of a test run using a chromatographic analyzer to control a debutanizer column. This marks a new phase of chromatography and is a logical development following the use of this analytical tool first in the control laboratory and then in process monitoring applications.

Punched Card Storage of Gas Chromatographic Data. C. F. Spencer and J. F. Johnson. *Anal. Chem. 30,* 893 (1958) May (2 pp.)

Standard IBM punched cards provide a method whereby gas chromatographic data can be conveniently stored, exchanged and made available for construction of charts and tables.

Separation by Paper Chromatography and Spectrophotometric Determination of Trace Amounts of Cobalt, Nickel, Copper and Zinc. W. J. Frierson, D. A. Rearick and J. H. Yoe. *Anal. Chem. 30,* 468 (1958) Apr. (4 pp.)

Microgram amounts of the elements cobalt, nickel, copper and zinc are separated by paper chromatography and quantitatively determined by standard spectrophotometric procedures. The method includes a two-solvent chromatographic separation, elution of the ions from sections of the chromatogram and spectrophotometric determinations. Several solutions of the eluted ions containing between 0.5-2.0 γ of the ions/ml show 96-100% recovery. Method may be applied to any combination of the four elements.

Trace Analyses by Gas Chromatography. C. E. Bennett, S. Dal Nogare, L. W. Safranski and C. D. Lewis. *Anal. Chem. 30,* 898 (1958) May (5 pp.)

Gas chromatography is applied to the determination of trace components (1-200 ppm) in organic mixtures by a combination of a thermal conductivity detector utilizing thermistors as sensing elements and an amplifier. Techniques necessary for obtaining low noise and drift levels are described. Specific applications are included.

Coal

The Direct Determination of Mineral Matter in Coal. M. Bishop and D. L. Ward. *Fuel 37,* 191 (1958) Apr. (10 pp.)

Investigations were conducted on the Radmacher and Morhrhauer method for direct determination of

mineral matter in coal. Tests on 13 samples of British coal indicate that good duplication is possible and that the method gives results which compare very closely with those obtained indirectly by use of the King, Maries and Crossley formula.

Dust

Improved Sampling Equipment for Solids in Flue Gases. P. G. W. Hawksley, S. Badzioch and J. H. Blackett. *J. Inst. Fuel 31,* 147 (1958) Apr. (15 pp.)

Equipment for separate determination of grit, dust and smoke concentrations in flue gases is discussed. Designed as a result of extensive testing, equipment has interchangeable parts and can be assembled in different forms. It is suitable both for routine measurements and for detailed investigations of the distributions of solids in ducts or for studying effects of operating conditions of a plant. Method of use is described.

Electron Microscopy

Electron Microscopy. T. G. Rochow and M. C. Botty. *Anal. Chem. 30,* 640 (1958) Apr. (17 pp.)

Progress in this field includes improvement of the reflection microscope, which is providing a new approach. The trend continues toward preparing samples representing steps in experimental and industrial processes, and more experiments are being performed within the microscope. Developments also have been made in imagery, gathering of chemical information, in electron and ion, cold-emission microscopes, in commercial microradiography and in experimental X-ray microscopy.

Emission Spectrography

Automatic Computer Program for the Reduction of Routine Emission Spectrographic Data. F. W. Anderson and J. H. Moser. *Anal. Chem. 30,* 879 (1958) May (3 pp.)

An IBM Type 650 computer with 2000 ten-digit words of memory is used to convert emission spectographic film line transmittances to element concentrations in samples. Assay precision, also computed, depends on whether procedure is semiquantitative or quantitative. Speed and accuracy of calculations are improved.

Emission Spectroscopy. B. F. Scribner. *Anal. Chem. 30,* 596 (1958) Apr. (9 pp.)

Extension of five earlier reviews by Meggers, most recent of which was published in 1956. Rate of publication in emission spectroscopy, largely in the applied field, continues to increase, with references for recent years averaging about 500 annually. Current review calls attention to contributions of basic importance or those representing new, unique or extensive applications. More complete literature coverage will be found in bibliographies, a major one being the latest by Van Someren which covers the period 1946-51.

Gas Analysis

Gas Analysis. A. P. Hobbs. *Anal. Chem. 30,* 778 (1958) Apr. (15 pp.)

Gas analysis methods which have appeared in the literature since 1950 have been reviewed. Outstanding development has been vapor phase chromatography. This fills a definite need, but other methods of analysis will still be needed for many jobs. Survey includes 343 items.

Hydrocarbons

Hydrocarbons from Petroleum. F. D. Rossini. *J. Inst. Petrol. 44,* 97 (1958) Apr. (11 pp.)

Summary of that part of American Petroleum Institute Research Project 6 which pertains to the composition of petroleum. The 500 gallons of crude petroleum taken from a well in the Ponca City field, Okla., in 1928 have been used continuously on this project. Results reported represent nearly 500 man years of work and an investment of about $1.5 million.

Infrared

Materials for Infrared. F. E. Tuttle. *Military Automation 2,* 52 (1958) Mar.-Apr.

Discussion of four recent developments in the infrared field: photosensitive resistors, IR interference filters, selenium glass and far-IR filters.

Infrared Spectroscopy

Infrared Spectroscopy. R. C. Gore. *Anal. Chem. 30,* 570 (1958) Apr. (10 pp.)

First comprehensive literature review since 1954 contains over 800 references. Categories covered in both years is the same.

Ion Exchange

Ion Exchange. R. Kunin, F. X. McGarvey and D. Zobian. *Anal. Chem. 30,* 681 (1958) Apr. (6 pp.)

Literature survey shows that practically all analytical studies involve organic ion exchange materials of some sort, including conventional ion exchange resins, permselective ion exchange membranes, chemically modified cellulose fibers and liquid ion exchangers. Ion exchange materials are now being employed for separation of closely related nonionic substances such as alcohols. The resins are being used for concentrating traces of metal ions prior to their colorimetric estimation.

Mass Spectrometry

Machine Computation of Mass Spectrometer Analyses. Triangular Inverse Method. H. F. Hopp and R. Wertzler. *Anal. Chem. 30,* 877 (1958) May (3 pp.)

Conventional inverse matrix method used in electronic data-computing programs of mass spectrometer analyses of gas samples is modified by using a triangular inverse method. This reduces certain inherent errors, particularly relative errors arising from subtraction of one large term from another. Total machine time for a 21-component mixture is 51 seconds, using an IBM 650.

Mass Spectrometry. V. H. Dibler and R. M. Reese. *Anal. Chem. 30,* 604 (1958) Apr. (10 pp.)

Representative portions of the literature published between January 1956 and November 1957 are included in this survey. This is particularly true for applications to reaction kinetics, stable isotopic tracer studies and nuclear reactions.

Semiautomatic Assembly of Mass Spectrometry Matrices. D. R. McAdams. *Anal. Chem. 30,* 881 (1958) May (5 pp.)

Calibration data from a mass spectrometer are adjusted using a medium-sized digital computer and assembling into a direct matrix in a form suitable for mathematical inversion. Corrections can be made for impurity components and instrument sensitivity changes. Program minimizes manual effort.

Transmission and Remote Calculation of Mass Spectrometer Data. C. H. Mihm, L. W. Pollock and R. O. Shelton. *Anal. Chem. 30,* 874 (1958) May (3 pp.)

Data-transmission system between an automatic computing center and a mass spectrometer has been constructed over a distance of 350 miles. The automatic computer increases accuracy and reduces calculation time from 24 hours to 1 minute/sample. Calculations can be made available to plant engineers within 24 hours after sample analysis.

Naphthalene

The Determination of Naphthalene in Gas. The Solubility of Picric Acid in Water and the Dissociation of Naphthalene Picrate. A. B. Densham and L. A. Ravald. *J. Appl. Chem. 8,* 267 (1958) May (4 pp.)

Solubility of picric acid in water has been determined for the temperature range 0°-30°. Previous results were determined to be too high below 15°. Dissociation of naphthalene picrate, and hence the naphthalene unabsorbed from gas by aqueous picric acid, is calculated thermodynamically for a range of conditions. Calculated values are compared with experimental results.

Oxygen

Determination of Oxygenated Materials as Group Types by Infrared Absorption. E. L. Saier and R. H. Hughes. *Anal. Chem. 30,* 513 (1958) Apr. (5 pp.)

Quantitative group-type analysis for determination, by infrared, of alcohols, acids, aldehydes, ketones, esters and ethers in a mixture. Absorbances are determined at six wave lengths and substituted into a matrix to give the concentrations. Integrated absorptions are employed whenever absorptions for members of a group vary in wave length or are split into components.

Phenols

Analysis of Low-Temperature Tar Phenols Boiling Up to 234°. C. C. Karr, Jr., P. M. Brown, P. A. Estep and G. L. Humphrey. *Fuel 37,* 227 (1958) Apr. (9 pp.)

Low-temperature bituminous coal tar phenols boiling up to 234°C have been identified and quantitatively determined by gas-liquid partition chromatography. Chromatographic fractions were collected for micro infrared analysis. These phenols also were determined by fractional distillation, followed by infrared analysis.

Spectrometry

Spectrophotometric Determination of Carbonyl Oxygen. F. H. Lohman. *Anal. Chem. 30,* 972 (1958) May (3 pp.)

Extremely accurate spectrophotometric method for determination of carbonyl oxygen utilizes the condensation reaction with 2,4-dinitrophenylhydrazine, forming the highly colored 2,4-dinitrophenylhydrazones. The hydrazone is selectively extracted with hexane, which eliminates reagent interference. Color density is measure at 340 mμ. Effective range is 3-300 ppm. Method has been applied to soybean and cottonseed oils and laurone in synthetic samples.

Ultraviolet Spectrophotometric Determination of Total Pyridines and Quinolines in Low Temperature Coal-Tar Distillates. T. L. Chang and C. Karr, Jr. *Anal. Chem. 30,* 971 (1958) May (2 pp.)

Total pyridines and quinolines can be determined spectrophotometrically by extraction from coal-tar distillates with 10% sulfuric acid and, after adjusting the pH to 12 with 10% sodium hydroxide, extracting with iso-octane. Ultraviolet spectrum is determined at 260 and 316.5 mμ. Large amounts of anilines will interfere.

X-Ray Spectrography

X-Ray Absorption and Emission. H. A. Liebhafsky and E. H. Winslow. *Anal. Chem. 30,* 580 (1958) Apr. (10 pp.)

Latest literature survey shows that X-ray emission is tending to monopolize the field. Several important topics are given extended treatment, and most of the review is devoted to summarizing in little space the more pertinent publications among over 300 references in the literature.

Relaxation Method

Continuous Distillation Calculations by Relaxation Method. A. Rose, R. F. Sweeny and V. N. Schrodt. *Ind. Eng. Chem. 50,* 737 (1958) May (4 pp.)

Relaxation procedure is entirely new method for calculating product compositions in multicomponent continuous distillation when feed conditions, flow rates, plate efficiency, number of plates and reflux ratio are established. Method is applicable to problems involving multiple feed or take-off streams, extremes of concentration, multiple columns and automatic control applications.

Oxygen

Means for Determining the Extent of Inert Impurities and Oxygen. L. J. Kressley and L. K. Frevel (assigned to Dow Chemical Co.) U. S. 2,829,953 (1958) Apr. 8.

After a preliminary combustion over palladium with excess hydrogen, the impurities in an oxygen stream plus hydrogen are compared with pure hydrogen in a thermal conductivity bridge.

13. BASIC SCIENCE

Adsorption

Adsorption of Activated Gases. D. G. Bills and N. P. Carleton. *J. Appl. Phys. 29,* 692 (1958) Apr. (6 pp.)

Adsorption of gases activated by electron bombardment has been investigated theoretically and experimentally. From postulates concerning probabilities of adsorption and deactivation for activated molecules in collision with surfaces, an expression is derived giving rate of adsorption in terms of these probabilities and of the amount of activated gas already adsorbed on the surface. This relation is also determined experimentally by a new method in which constant pressure is maintained in the adsorption vessel by admitting gas to it from a reservoir through a controlled leak, while the adsorption is taking place.

Nickel Powder with Adsorptive Properties Approaching Those of Evaporated Nickel Films. M. W. Roberts and K. W. Sykes. *Trans. Faraday Soc. 54,* 548 (1958) Apr. (9 pp.)

Surface of nickel powder was investigated by measurement of hydrogen and krypton adsorption throughout the course of reduction in hydrogen for 102 hr at 450°C. Adsorptive behavior closely approaching that known to be exhibited by evaporated nickel films has been observed as a result of a gradual improvement in surface purity. This is attributed to the removal of surface oxide by reduction and of involatile impurities by aggregation into separate phases or diffusion into the lattice.

Transitions in Adsorbed Monolayers. B. B. Fisher and W. G. McMillan. **Part 1. Experimental.** *J. Chem. Phys. 28,* 549 (1958) Apr. (6 pp.); **Part 2. Theoretical.** *Ibid.,* 555 (1958) Apr. (7 pp.); **Part 3. Results and Comparison.** *Ibid.,* 562 (1958) Apr. (10 pp.)

Preparation of sodium bromide samples on which adsorbed krypton and methane exhibit transitions in the region below one monolayer are described in Part 1. For the theoretical work, the grand partition function is employed to derive the isotherm and the two-dimensional equation of state corresponding to a model of localized monolayer adsorption in which the lateral vibrational partition function is permitted to depend on the occupation number of neighboring sites. Experimental and theoretical results are then combined to yield "experimental" values of the adsorption parameters for nitrogen, krypton and methane on sodium bromide.

The Two-Dimensional van der Waals Constants of Molecules Adsorbed on Charcoal and Graphite. J. H. deBoer and S. Kruyer. *Trans. Faraday Soc. 54,* 540 (1958) Apr. (8 pp.)

Entropy data indicate that physically adsorbed molecules of many gases on charcoal or on graphite are mobile and freely rotating. This is in accordance with other data and induced application of a two-dimensional van der Waals equation to the adsorption data. It is then found that the adsorbed molecules repel each other. Explanation of this repulsion by the repulsion of dipoles, induced in the adsorbed molecules by the surface, enables derivation of dipole moments which are in accordance with data.

Vapor Transfer through Barriers. K. Kammermeyer. *Ind. Eng. Chem. 50,* 697 (1958) Apr. (6 pp.)

Investigations of a number of workers in the field provide adequate data which permit a rather satisfactory correlation of vapor transport with adsorption characteristics. Thus, vapor transport can be analyzed for both plastic films and for microporous barriers. This would indicate that the correlation is generally applicable. Data for 14 systems are available, including water vapor and inorganic and organic vapors in transport through barriers such as plastic films, paper and silica and carbon powders.

Powders in compressed form represent microporous barriers.

Air Pollution

Deposition of Dust Particles from Industrial Stacks. G. T. Csnady. *Australian J. Appl. Sci. 9,* 1 (1958) Mar. (8 pp.)

Sutton's continuous point-source equations, previously extended by the author to the study of dust of uniform free-falling speed (discharged from a tall stack into a horizontal wind), now is applied to industrial dust with continuous particle-size distribution. To facilitate appreciation of the results some new concepts are introduced and the characteristic features of instantaneous fall of dust are discussed. Averaging deposition rates for wind speed and direction is then considered and it is shown how the weather data generally available can be utilized.

Bond Dissociation

Studies in Electron Impact Methods. Part 2. The Latent Heat of Sublimation of Carbon. R. I. Reed and W. Snedden. *Trans. Faraday Soc. 54,* 301 (1958) Mar. (7 pp.)

An investigation, by electron impact methods, into the mode of decomposition of CF_4, CCl_4 and CBr_4 has enabled a mechanism of fragmentation to be assigned to each of these. Values for the bond-dissociation energies have also been obtained as well as the latent heat of sublimation of carbon.

Carbon Reactions

Reaction between Silica and Carbon and the Activity of Silica in Slag Solution. J. D. Baird and J. Taylor. *Trans. Faraday Soc. 54,* 526 (1958) Apr. (14 pp.)

Carbon monoxide pressure of the reaction $SiO_2 + 3C = SiC + 2CO$ has been measured at temperatures between 1400°-1580°C. Precautions were taken to minimize the effect of silicon monoxide diffusion and insure that the true equilibrium pressure was measured. The free energy of formation of silicon carbide has been calculated from the results. Value obtained is considerably less than that of previous investigators.

Diffusion

Thermal Diffusion in Dense Gases. J. E. Walther and H. G. Drickamer. *J. Phys. Chem. 62,* 421 (1958) Apr. (5 pp.)

Thermal diffusion measurements have been obtained on a series of binary mixtures of gases to 500 atm. Mixtures far from the critical temperature showed only small pressure effects. For systems where one component is near its critical temperature, a large negative value of the thermal diffusion ratio α is obtained. Kinetic theories and thermodynamics of irreversible processes offer insight into the phenomenon.

Distillation

Better Estimate of Entrainment from Bubble-Cap Trays. J. R. Fair and R. L. Matthews. *Petrol. Refiner 37,* 153 (1958) Apr. (6 pp.)

Empirical method estimates entrainment in bubble-cap columns on a theory of "corresponding states" involving conditions relative to flooding. Design charts are presented for estimating both entrainment and flooding. In the region where entrainment affects distillation efficiency significantly, the correlation is shown to represent experimental data from a variety of sources within ±20%.

Design Packed Columns Graphically. J. J. Czermann, S. L. Gyokhegyi and J. J. Hay. *Petrol. Refiner 37,* 165 (1958) Apr. (8 pp.)

Height, diameter and pressure drop of a packed column may be obtained with the aid of diagrams. Article does not attempt to completely summarize general questions referring to packed absorption or distillation column designs. Rather, a new graphical method of solution is proposed. Technical literature is referred to on theoretical grounds and general design problems.

Distilling Column

Use Digital Computers as Distillation Column Design Aid. R. N. Maddox. *Petrol. Eng. 30,* C-15 (1958) Apr. (4 pp.)

Combining short-cut with rigorous methods can reduce machine time for designing a butane splitter.

Equilibria

An Iterative Method of Determining Equilibrium Compositions of Reacting Gases. S. T. Chu. *Jet Propulsion 28,* 252 (1958) Apr. (3 pp.)

Method presented differs from others in that the efficiency of iteration should be independent of whether the mixture is far from or close to the stoichiometric proportions. Furthermore, method is claimed to provide explicit correction terms for each succeeding iteration; i.e., solutions of each iteration may be obtained by simple algebraic operations whose forms remain invariant for all orders of iterations.

Fluid Flow

Experimental Velocity and Temperature Profiles for Air in Turbulent Pipe Flow. C. A. Sleicher, Jr. *Trans. ASME 80,* 693 (1958) Apr. (12 pp.)

Description of an experiment in which the ratio of eddy diffusivity for heat to that for momentum was

calculated from measured velocity and temperature profiles of air in fully developed flow in a pipe at uniform wall temperature. The ratio was found to vary with Reynolds number and position, and in all cases was above the value of unity used by many investigators. The ratio approached a constant of about 1.4 very near the pipe wall.

Fluidization

Minimum Fluidizing Velocities for Coal in Air. C. G. Sinclair and D. B. Robinson. *Can. J. Chem. Eng. 36,* 51 (1958) Apr. (8 pp.)

Review of methods which have been proposed for evaluating lower limit of velocity for which a fluidized bed of solids will be stable. Experimental tests for determining the minimum fluidizing velocity have been obtained for nine narrowly sized coal samples ranging from 0.0099 to 0.224 in. in diameter and for one widely sized sample less than a No. 10 Tyler sieve using dry air at atmospheric conditions in a 5½-in. diameter bed.

Heat Radiation

How to Calculate Thermal Radiation from Hot Surfaces. G. V. Thompson. *Product Eng. 29,* 116 (1958) Mar. 31 (2 pp.)

Chart aids selection of surface finishes and temperature levels that dissipate heat to atmosphere faster.

Heat Transfer

Convective Heat Transfer from High-temperature Air Inside a Tube. H. E. Zellnik and S. W. Churchill. *A.I.Ch.E.J. 4,* 37 (1958) Mar. (6 pp.)

Local rates of heat transfer were determind at 1.5, 4, 7 and 10-in. tube diameters from the entrance by measuring the radial temperature profile in thermally isolated, annular sections of the tube wall. Local rate data for all gas temperatures are well represented by previous correlations for small temperature differences if the gas properties are evaluated at the bulk temperature rather than at the film temperature. Data agree well with those of previous investigations wherever the experimental ranges overlap.

Fluid-particle Heat Transfer in Packed Beds. E. B. Baumeister and C. O. Bennett. *A.I.Ch.E.J. 4,* 69 (1958) Mar. (6 pp.)

Steady state heat transfer experiments were carried out in a 4-in I.D. transite tube packed with ⅜, ¼ and 5/32-in. steel spheres. Heat was generated in the pellets by means of a high-frequency induction coil surrounding the test section. Average heat transfer coefficients between the bed of spheres and a stream of air passing through the bed were calculated for Reynolds numbers of from 200 to 10,400. To insure the reproducibility of the data, the bed was repacked six times for each pellet size.

Friction and Heat Transfer in a Rough Tube at Varying Prandtl Numbers. R. C. Hastrup, R. H. Sabersky, D. R. Bartz and M. B. Noel. *Jet Propulsion 28,* 259 (1958) Apr. (5 pp.)

Experiments were conducted in an electrically heated tube with water as a working fluid. By using water at various temperatures, experiments could be performed over a continuous range of Prandtl numbers from about 1-7. For the tube and the type of roughness used in this experiment, the results confirm that roughness increases the heat transfer as well as the friction coefficient, but that the ratio C_h/C_f decreases with increasing roughness. The latter effect appeared slightly more pronounced at the lower Prandtl numbers.

Heat and Momentum Transfer in the Flow of Gases Through Packed Beds. M. B. Glasser and G. Thodos. *A.I.Ch.E.J. 4,* 63 (1958) Mar. (6 pp.)

Heat and momentum transfer studies have been conducted for the flow of gases through fixed beds consisting of randomly packed, solid metallic particles. Experimental technique used enabled procurement of gas-film heat transfer data under steady state conditions and in the absence of mass transfer effects. Experimental runs have been carried out for spheres, cubes and regular cylinders using hydrogen and carbon dioxide to extend the range of molecular weights beyond that of air, used for the majority of these runs. A particle-size, column-diameter effect was found to exist for both heat and momentum transfer. This becomes significant in the low Reynolds region.

Heat Transfer. E. R. G. Eckert, J. P. Hartnett and T. F. Irvine, Jr. *Ind. Chem. Eng. 50,* 543 (1958) Mar. (12 pp.)

Considerable research effort was initiated because of cooling problems on satellites and missiles, directing attention to conditions of extreme speed and low density. Developments in reactor engineering were obviously responsible for intensive research in boiling heat transfer and for renewal of interest in liquid metals as coolants.

Heat Transfer Between Fluidized-solids Beds and Boundary Surfaces—Correlation of Data. L. Wender and G. T. Cooper. *A.I.Ch.E.J. 4,* 15 (1958) Mar. (9 pp.)

Broad empirical study of nine independent sets of data on fluidized-bed heat transfer, with correlation of data in two groups. Wide range of many variables is included, and some data on commercial units are presented. Data for external and internal heat transfer surfaces are correlated graphically.

Heat Transfer from Superheated Vapors to a Horizontal Tube. G. Balekjian and D. L. Katz. *A.I.Ch.E.J. 4,* 43 (1958) Mar. (6 pp.)

Experimental data are presented for condensing tetrafluorodichloroethane and steam at several pressures. An interfacial coefficient of heat transfer between the superheated vapor and the condensate surface is reported based on the computed surface temperatures. Schrage's analysis and equations for relating mass and heat transfer with conditions at an interface were simplified and used to correlate the experimental condensing load with the degree of superheat.

Heat Transfer to a Gas-Phase Chemical Reaction. W. Schotte. *Ind. Eng. Chem. 50,* 683 (1958) Apr. (8 pp.)

Report of a study of heat transfer to a flow system which undergoes a nearly instantaneous chemical reaction. Experiments and theory have shown that an order-of-magnitude increase in the convection heat-transfer coefficient may result from dissociation and association reactions in the gas phase. Heat-transfer coefficients can be predicted from conventional correlations when effective thermal conductivities and effective specific heats are required.

Natural-convection Heat Transfer in Regions of Maximum Fluid Density. R. S. Schechter and H. S. Isbin. *A.I.Ch.E.J. 4,* 81 (1958) Mar. (9 pp.)

Investigation consisted of measuring heat transfer rates, velocity gradients and temperature profiles when heat is transferred from a flat vertical plate to water in the region of 4°C. In some experiments, the flow in the boundary layer was observed to be downward while at other conditions of plate and fluid temperature a dual motion was noted, thus establishing a basic difference in the heat transfer mechanism and precluding a unified theory. Theoretical consideration is given to each mechanism and a criterion is derived to predict the flow regime which will prevail at fixed conditions of plate and bulk temperatures.

Radiant Heat Exchange in a Gas-filled Enclosure: Allowance for Nonuniformity of Gas Temperature. H. C. Hottel and E. S. Cohen. *A.I.Ch.E. J. 4,* 3 (1958) Mar. (12 pp.)

Method for predicting effect of allowance for radiation exchange on distribution of temperature and heat transfer within a furnace chamber. System is divided into surface zones and gas zones, the number being dependent on the desired accuracy of the result. Direct-exchange factors are available for gas-gas, gas-surface and surface-surface zone interchange.

Hydrocarbons

The Catalytic Synthesis of Cyclopentadient Hydrocarbons. N. I. Schujkin and T. I. Naryschkina. *Erdöl u. Kohle 11,* 153 (1958) Mar. (4 pp. German text.)

Two methods of preparation of cyclopentadiene hydrocarbons are studied: the catalytic dehydrogenation-cyclization of alkadienes and the catalytic dehydrogenation of five-carbon cyclenes and cyclanes. Both methods yield cyclopentadiene (59-94% crude and 18-47% pure). Optimum conditions were 600°C and 20-25 mm. Branched 6-carbon alkadienes give more favorable yields by cyclization than linear pentadienes.

Hydrogen

Ortho-Para Catalysis in Liquid-Hydrogen Production. D. H. Weitzel, W. V. Loebenstein, J. W. Draper and O. E. Park. *J. Research 60,* 221 (1958) Mar. (7 pp.)

Series of selected catalysts were investigated for their ability to accelerate the ortho to para conversion of hydrogen. Results of study are discussed, and performance of various catalysts are compared with that of chromic oxide on alumina pellets. One and one-half liters of an outstanding catalyst, unsupported hydrous ferric oxide granules, have now been used to convert more than 100,000 liters of liquid hydrogen to 90-95% para at an average rate of about 235 liters/hr. To date, there is no evidence of decrease in efficiency with continued use.

Liquefaction

Joule-Thomson Process in the Liquefaction of Helium. E. H. Brown and J. W. Dean. *J. Research 60,* 161 (1958) Mar. (8 pp.)

Dimensionless, normalized, correlating function is introduced for the specific enthalpy of helium. Using this function, consistency of various enthalpy data is determined. These data are then used to determine curves of helium liquefaction yield in the region of variable specific heat in terms of heat-exchanger efficiency.

Permeability

The Generalized Kozeny-Carman Equation. M. R. J. Wyllie and G. H. F. Gardner. **Part 1. Review of Existing Theories.** *World Oil 146,* 121 (1958) Mar. (5 pp.); **Part 2. A Novel Approach to Problems of Fluid Flow.** *Ibid.,* 210 (1958) Apr. (9 pp.)

Various explanations have been offered for multiphase relative permeabilities. These have centered around the much misunderstood "tortuosity factor." Their theoretical and experimental basis are systematically presented in Part 1. Part 2 demonstrates how a capillaric model for a porous medium, com-

bined with a random interconnection of pores, leads to a simple statistical theory. The tortuosity factor receives a new significance.

Radiation Applications

Tritium Tracing—A Rediscovery. *Nucleonics 16,* 62 (1958) Mar. (6 pp.)

Improved labeling techniques, more sensitive detection and lower price bring new usefulness to tritium. Good half-life and versatility make this radiohydrogen valuable to biologists, chemists and geologists.

Double-Bond Formation in Paraffinic Hydrocarbons on Exposure to Ionizing Radiation. R. M. Black. *J. Appl. Chem. 8,* 159 (1958) Mar. (5 pp.)

Changes in the amounts of unsaturation induced by pile irradiation of a range of paraffinic hydrocarbons have been investigated by infrared absorption measurements and by measurement of the iodine number. Changes in the various types of unsaturation, *trans*-vinyl, vinylene and vinylidene are compared for *n*-decane, petroleum jelly and polyethylene, and discrepancies between the two methods are discussed.

Steam Tables

The 1957 Status of Steam Properties. F. G. Keyes. *Trans. ASME 80,* 555 (1958) Apr. (6 pp.)

In addition to tabulations of equilibrium thermodynamic qualities, a new steam table must exhibit tabulated information for thermal conductivity, viscosity and Prandtl numbers over the pressure and temperature range. Tabulations of standard specific heats should also appear as should adequate information on relaxation time from velocity of sound measurements or perhaps also from other methods of measurement. Recent contributions of Russian, British, German and U.S. investigators are reviewed in the project to extend limits of properties to 15,000 psia and 1500°F.

Solubility

Solubility, Entropy and Partial Molal Volumes in Solutions of Gases in Non-polar Solvents. J. E. Jolley and J. H. Hildebrand. *J. Am. Chem. Soc. 80,* 1050 (1958) Mar. 5 (8 pp.)

Critical review of several gas solubilities revealed the following relationships: 1) for a given gas at 1 atm and 25° dissolving in a series, log x_2 decreases with increasing solubility parameter, ∂_1, of the solvent and 2) for different gases in the same solvent, log x_2 increases linearly with increasing Lennard-Jones force constant, ϵ/k, of the gas.

Sorption on Coal

Kinetics of the Sorption and Desorption of Methanol on Coal. P. Fugassi, G. Ostapchenko and R. Trammell. *Fuel 37,* 36 (1958) Jan. (11 pp.)

Sorption and desorption rate of methanol on Pittsburgh seam coal has been studied at 30°, 35° and 40° C. From these tests and from a literature survey it appears that sorption and desorption follow a second order rate equation if the vapor is a substance whose formula includes oxygen and if the solid is a swelling gel of the polysaccharide or protein type.

The Interaction of Organic Vapours with Coal I—The Reversible Sorption of Methanol and Pentane. P. Fugassi, R. Hudson and G. Ostapchenko. *Fuel 37,* 25 (1958) Jan. (4 pp.)

Investigation of sorption of methanol and *n*-pentane on Pittsburgh seam coal at 35°C using a gravimetric method. The sportion is isothermally reversible. Sorption and desorption of methanol on a given coal sample increases the subsequent sorption of pentane by about 100%. Pentane sorption and desorption decreases subsequent sorption of methanol by about 10%. Data indicate that coal gel structure is changed irreversibly by the sorption of methanol and pentane.

Surface Tension

Surface Tension for Pure Liquids. W. R. Gambill. *Chem. Eng. 65,* 146 (1958) Apr. 7 (5 pp.)

Values of surface tensions of liquids are necessary in a number of correlations. Pertinent technical areas include two-phase (vapor-liquid) fluid flow; nucleate-boiling heat transfer; oil recovery processes; emulsion theory and distillation column design, where surface tension figures in the estimation of quantities such as interfacial area, plate spacing, slot opening, entrainment rate and liquid holdup (for packed columns).

Vaporization Equilibria

Equilibrium Data Now Available for Cyclohexane. D. S. Hoffman and J. H. Weber. *Petrol. Refiner 37,* 143 (1958) Feb. (3 pp.)

Practical method for calculating vaporization equilibrium constants for pure components. Data for cyclohexane demonstrate operation of method.

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